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A Rejoinder to some Recent Ethnological Papers - - 1

NATIONAL MUSEUM
VICTORIA.

A REJOINDER TO SOME RECENT ETHNOLOGICAL PAPERS (1), (2), (3)

By WALTER HOWCHIN,

Emeritus Professor of Geology and Palaeontology, University of Adelaide.

While engaged in geological field-work on Kangaroo Island, in 1902, the writer came upon evidences of a previous occupation of the island by aborigines. As it had been believed previously (from negative evidence) that the Australian natives had not crossed from the mainland to the island, it was thought worth while to incorporate the facts thus obtained with other observations made at the time. As my main object in visiting the island was in other directions, only such anthropological observations that came casually under my notice were recorded, concluding with the words, "Now that attention has been called to this subject it is probable that further evidences of the occupation of Kangaroo Island by an aboriginal population will be secured" (No. 4). Two localities were specially noticed. One of these was at Hawk's Nest, where the implements were formed from quartzite. The other was on the southern coast, at the Brecknells sand-dunes, in which worked stone implements were discovered; adjacent to which were the remains of two heaps of broken and whole sea-shells that had the characteristics of being "kitchen middens" left by the aborigines.

In the Records of the South Australian Museum for 1931 (1), Messrs. Tindale and Maegraith published a paper describing a visit to the island and the collection of further native implements. Their chief collecting ground was, as noted in my case, around Hawk's Nest. In the preamble to their paper they state, "In the following paper the Hawk's Nest occurrence is described in detail, after which brief records of some other localities, some corrections in a previous account, and a general discussion are given" (p. 276).

The promised "corrections in a previous account," which is stated to be "Howchin's," were placed under a separate heading, and included two items. The first of these dealt with the "kitchen middens," which my critics declared

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(1) "Traces of an Extinct Aboriginal Population on Kangaroo Island," by Norman B. Tindale and Brian G. Maegraith.

(2) "Notes on the Supposed Primitive Stone Implements from the Tableland Regions of Central Australia," by Norman B. Tindale.

(3) "A Contribution to the Study of Eoliths; Some Observations on the Natural Forces at work in the production of Flaked Stones on the Central Australian Tablelands," by F. Wood Jones and T. D. Campbell.

had been formed, not by human agency, but by the action of sea-birds, or the effects of waves, which may have carried up the shells from the beach on to the top of the cliffs. The possibilities of such a fortuitous origin of the shell-mounds had been discussed in my paper, and a decision reached on the following evidences:

(*a*) Its height above the beach. My critics gave their estimate at 6 metres; my estimate was 30 feet. The cliff was vertical, with a slight shelving towards the beach at its summit.

(*b*) The great extent of the shell-covered area, that measured 50 yards by 20 yards.

(*c*) The size of the mound and the great number and variety of the shells, which included some very large examples. The large *Turbo stamineus* was plentiful. One example, that I still possess, measures 12 inches in girth, and although much weathered weighs 9½ oz. The number of this species present may be judged from the fact that I brought away with me a dozen opercula that belonged to other examples of the same species and of equal size; also a shell of the large and very rare gasteropod, *Charonia (lampas) rubicunda*, which has a local distribution and is near extinction.

(*d*) Situated back from the cliffs a vertical section of the sand-dunes, cut by the wind, exposed another "midden," of like kind, in a layer of shells with drift-sand both above and below it. This was a collection that could not have been cast up by the sea. It is significant that this essential part of the evidence is ignored in the criticism, as it proves destructive to the theory brought forward.

(*e*) The fact that nearly thirty years had elapsed since my observations were made should have led the critics to exercise caution in basing an argument on such unstable factors as a shell mound that had been exposed to the weather on a wind-swept headland over so long a time.

If this first "correction" fails to carry its point, the second is hopelessly astray; it calls in question the validity of my determinations of the quartz implements that I obtained from the sandhills of the same neighbourhood, and implies that these quartz specimens were there in a fortuitous way, and that their fracture was caused, not by human agency, but by "thermal action," or in other words, by sun-flaking. The authors write: "As mentioned by Howchin, numbers of small quartz flakes were found to be present at low levels in the sandhills at the Brecknells; none of these showed signs of intentional manufacture; in one case it was possible to fit several pieces together and to see that thermal action had caused the flaking. Quartz pebbles were also found on the adjacent beach. All of the quartz chippings seen by the writers at this beach must be regarded as

formed by the natural weathering of quartz pebbles washed up during heavy weather'' (No. 1, p. 284).

(*a*) I did not mention any ''low levels'' in my paper. As a matter of fact the implements were found in the deep, wind-blown hollows of the sandhills, 100 feet or more above sea-level. In the same hollow I was fortunate in finding the bones of the small extinct emu of Kangaroo Island. The presence of these stones (one, a well-flaked core, weighs 7 oz.) under such circumstances is in itself a sufficient proof of human agency, as they could not occur in such a position by any other means.

(*b*) In a re-examination of the quartz specimens from the Brecknells, in my possession, I find they total 38 specimens, including 1 scraper, 1 gouge, 1 awl, 10 points, 23 flakes and chips, and 2 cores. It is extraordinary that, because (as stated by my critics) 'All of the quartz chippings seen by the writers at this beach must be regarded as formed by the natural weathering of quartz pebbles washed up during heavy weather,'' they should make, by implication, the ''correction'' in my paper without having seen the objects they condemn.

(*c*) The writers proceed (*loc. cit.*) : ''In one case it was possible to fit several pieces together and to see that thermal action had caused the flaking.'' This is remarkable, for quartz, as an hexagonal crystalline form, is a very refractory mineral, and has no definite cleavage, but a hackly, irregular fracture. It does not show the same facility of fracture by ''thermal action'' that amorphous silica does, so that for one to be able to collect and piece together such irregular fragments, if they had been caused by natural processes, would be miraculous, especially if he had to collect the fragments from a wind-swept trough of shifting sands.

As the occupation of Kangaroo Island by aborigines was definitely proved by myself in 1903, and by Tindale and Maegraith nearly thirty years later, the scientific facts had been established quite independently of the evidences at the Brecknells. These authors ignore the time factor of an interval of nearly thirty years, omit material evidence in the existence of a second shell-heap, beyond the reach of the waves, and, by implication, condemn the validity of a collection of native implements they had never seen.

The second paper under notice (No. 2) appeared in the previous volume of this publication (vol. iv, 1932, p. 483).

In 1921 the present writer described a collection of stone implements from Central Australia (No. 5), which forms an exhibit in the South Australian Museum. Tindale, in a criticism of my determinations in the paper referred to, associates his paper with another on the same subject, published by Professor

Wood Jones and T. D. Campbell (No. 3), which he considers so conclusive that, in his opinion, "it would appear almost unnecessary to consider any further the validity of these objects," and then offers a presentation of "the problem from quite a different view-point" (No. 2, p. 488). It will be necessary to consider Wood Jones and Campbell's paper first.

In the paper by Wood Jones and Campbell the authors have spent much labour in explaining and illustrating the phenomena of rock-splitting under natural weathering, especially under the strain brought about by differential diurnal temperatures that exist in Central Australia. Such phenomena are a commonplace to geologists, especially to Australian geologists, and I had already devoted three pages in the article these authors criticized in describing and defining these features. I am quite in accord with them on the broad aspects of the question when properly applied.

The real object of the paper is to associate the specimens that I have described as human tools with the naturally flaked stones of the interior. On page 116 we read: "Are these flaked stones of the Australian tableland the work of man, as has been claimed? In the first place, it would seem impossible that human agency could be invoked for the flaking of all these myriads of stones, when we consider that the barren tablelands, during what we may describe as the life-cycle of the stones, have been places altogether unattractive for human habitation, or even for human adventure."

On a later page (p. 122) they repeat this idea in the sentence: "We also consider that a human origin for the countless millions of them scattered over hundreds of square miles of tableland country is incredible." I quite agree. No one could imagine that these "countless millions" of stones that form the stony deserts of Australia had been individually chipped by human hands, and yet I am credited with this absurd idea. The fact is that, as the result of my two excursions into Central Australia, among these "countless millions" of gibbers, I collected less than fifty specimens that were considered to be of human workmanship.

The authors of the paper under discussion have greatly exaggerated the solar-flaking that takes place on these stony gibbers. The latter very commonly show original bedding-planes, vertical jointing, and irregular fractures, but rarely a smooth concave surface that might have resulted from insolation; and, still more rarely, a secondary lineal flaking, by minor pittings, which latter, when they do occur, can be easily distinguished from chippings that are caused by design. If (as suggested by these authors) these "countless millions" of bare desert-stones

had been subjected to such universal sun-flaking throughout their long life-history of a million (more or less) years, they should all, by this time, have been reduced to their ultimate sun-flaked chips.

The argument advanced by Wood Jones and Campbell deals exclusively with general principles, which, in their proper application, no one disputes; the vital point, however, centres in the validity or invalidity of certain objects as human tools. The question rests, not on abstract principles, but with certain specified concrete objects, and these are not considered in any way by my critics. To make their criticism effective they must show one or other of two things, either that the so-called implements do not give evidence of human workmanship or that the flaking and chipping, in each particular specimen, can be adequately explained as the result of natural causes. This the authors have not done. They have not challenged a single specimen, so that their argument is pointless and irrelevant; they leave the question where they found it.

In a further misrepresentation Wood Jones and Campbell have credited me throughout with defining these tableland specimens as *eoliths*, and it is this view of the subject that claims their chief attention.

On page 116 of their paper we read: "There is an extremely difficult problem to face if in Australia there be, in fact, a real eolithic culture, as has been claimed [In footnote (1), "Howchin, Professor Walter"], sundered from the typical culture of the blackfellow by an unbridged cultural gap." I have never classed these implements as "eoliths," nor do I think that they are such, and in only one instance have I used the term in connection with these objects—and then merely incidentally. In my paper under criticism detailed descriptions are given of 16 examples of tableland implements. In the case of No. 8 specimen, among other features described, it is casually stated that it "resembled a common eolithic type." This is the only place where I have used the term with reference to the tableland specimens. This statement is, moreover, governed by what is said on p. 224, viz.: "The stage of culture, indicated by any particular group of artefacts, is determined by the highest and most characteristic types in the group."

Types of lower cultures frequently occur casually among even the highest forms of stone implements, a fact well known to experienced collectors, and it was in this sense that a passing comparison was made with respect to No. 8 specimen. Yet Wood Jones and Campbell have seized on this sentence of five words, that had no general application, to build up their pseudo-critical theory. The point is laboured to such a degree that they have attributed to me this theory no less than sixteen times, varied by such phrases as "the eoliths," the "so-called eoliths," the "plateau eoliths," and "an eolithic culture claimed by Howchin." I have made no such pretensions. Notwithstanding all this, Tindale, considering that

this paper had dealt a finishing-stroke to the subject, states that it is "almost unnecessary to consider further the validity of these objects."

Under the heading, "Origin of the Implements," I have suggested (p. 216) several possible theories as to their authorship. Briefly stated, they were:

(*a*) A local variety of implements produced by the existing Australian natives, modified by the nature of the raw material, and having a considerable antiquity.

(*b*) Early and ruder attempts at the making of stone implements by the present race of aborigines at a time when less developed in the art than at present.

(*c*) The remains of an earlier race of people, as the Tasmanians, for example, during a former occupation of the continent.

The last-named seemed the most probable, on the high probability (reaching almost a certainty) of the Tasmanians being the true autochthonous race of Australia. This view is also, apparently, confirmed from the great similarity that many of the tableland specimens bear to the stone implements made by the Tasmanians.

Some ten or fifteen years ago there was a rather lively discussion among the archaeologists of Europe on the eolithic question, which was referred to in my paper. In these discussions the Tasmanians were referred to as "representing one of the most primitive and generalized types of mankind." Professor Sollas (*), whom I quoted, says, "The Tasmanians, though recent, were at the same time a Palaeolithic, or even, it has been asserted, an 'Eolithic' race . . . the most unprogressive in the world, which, in the middle of the nineteenth century, was still living in the dawn of the Palaeolithic epoch" (†). Sollas is not expressing his own views that the Tasmanian stone implements were "eoliths," but is stating the views of others. And I stated: "The point of interest in these discussions, so far as the present paper is concerned, is that several authors have drawn comparisons between the Tasmanian stone implements and the eolithic, or prepalaeolithic, implements of Europe." The object of these references was purely historical, and was in no sense, either on the one side or the other, an expression of my own views.

There has been much confusion in the discussion of this subject. To get a clearer view of its bearings we raise the question, What is an eolith? Mr. G. G. MacCurdy (No. 6), the Director of the American School of Prehistoric Research in Europe, defines it as follows: "Granted that there be an Eolithic Period, the

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(*) "Ancient Hunters," quoted from the 1911 Edition.

(†) It would have been more appropriate to have used the words Palaeolithic culture instead of "Palaeolithic epoch," as a past epoch (or geological stage), when passed, can never be repeated.

definition of an eolith becomes a comparatively simple matter. An eolith is a flint (or other stone) that has been shaped or utilized by man or his precursor during the geological period known as the Tertiary.'' MacCurdy is correct. The word eolith involves the factor of time. It is the ''dawn''—the stage in the development of the human creature when he first learned to shape stones as implements for use—and, according to the evidence, this seems to have happened in a late Tertiary Age. Who can imagine that humanly-worked stones have lain on an exposed surface of Central Australia from Tertiary times? There can be only one ''dawn.'' The ''coliths'' whatever they are, belong to the Tertiary Age. It would be as great an anachronism to call present-day stone implements ''eoliths'' as it would be to use the word Eocene (the dawn of modern life) as applicable to any shellfish existing in present seas. The coliths, Tasmanian artefacts, and tableland implements represent respectively three independent classes, both as to time and type, and must be judged on their respective merits.

In my paper there are sections on ''The Origin of the Implements,'' and also a ''Summary and Conclusions.'' Had I really considered the tableland implements to be coliths I could not have avoided stating the fact under such headings, but the word was never mentioned.

When discussing the Tasmanian implements I stated (p. 224): ''The stage of culture indicated by any particular group of artefacts is determined by the highest and most characteristic types in the group. Thus the polished implement clearly defines the Neolithic stage, while the relative diversity of type-forms and the finish shown in the workmanship are made the basis in distinguishing the respective stages that preceded the Neolithic standard. It is on the principles just stated that the Tasmanian standard of culture, in implement making, is placed at about the lowest level.'' This does not class the Tasmanian objects as coliths, which are still in a doubtful category, and with which, for reasons already given, the Tasmanian artefacts cannot be synchronized. The latter are a very isolated group, and are better placed in a distinct class (or perhaps two), as suggested by Dr. Noetling (No. 7) as quoted by me (p. 219). The definitely shaped implements such as scrapers, he calls ''morpholithes''; and those of an irregular, or less defined kind, he calls ''amorpholithes.'' This meets the difficulty of finding a place for a very primitive type of implements, without involving an inconsistency by calling them either palaeolithic, prepalaeolithic, or eolithic. Place the Tasmanian implements where you will in the archaeological scale of culture, the tableland specimens have an independent setting, and are too little known at present for classification, hence the absurdity of calling them ''coliths.'' They present a new field for archaeological investigation, and may yield most interesting results.

The third paper under notice is, as already stated, by Mr. N. B. Tindale (No. 2). Tindale, like his associates, must have read my paper carelessly, as he makes me responsible for statements I have not made, and which are foreign to my true position. For example, he opens his paper by saying, "In 1921 Howchin described some flints from the plateau region of Central Australia." The fact is that the implements concerned are *not* flints, and the only time that I used the word "flints" in my paper was to say that they were not flints but desert sandstone" (p. 209). Neither were they stated to be "plateau flints." Central Australia cannot be properly called a "plateau." The terms "tableland" and "tabletop" were used by me from their general use, but the more appropriate terms, "mesas" and "buttes," were suggested.

Tindale has also picked up the "*eolith*" myth, and freely uses such phrases as "Howchin's eoliths," "his eoliths," the so-called "plateau eoliths," etc., and in each case places the terms under quotation marks. This, of course, places the critic under the responsibility that he is representing the exact words of the paper that he criticizes, which is not the case.

Tindale does attempt to apply a scientific test as to the validity, or otherwise, of the objects in question. Archaeologists have come to recognize certain characteristic features in prehistoric stone-craft, which Tindale recapitulates (p. 483), briefly put, as follow: "In humanly-made flint implements the blows struck against the edge tend: (1) To be delivered at a constant angle. (2) The flakes removed are not usually squat, and are detached in such a manner as not to leave a step or edge at the point of the final separation from the implement. (3) Ripple marks are seldom numerous. (4) The secondary scars tend to be confined to one face, and produce a straight cutting-edge. (5) The greatest part of the work has been done at one time.

These criteria are based on the ideal—the perfect implement—and are subject to many limitations and exceptions. Every experienced collector knows that the mathematically correct implement, such as Tindale defines, is a very rare object. The necessary conditions would be an inherited traditional high standard of stone culture—a highly efficient workman—a flawless stone that is homogeneous in composition, with a perfect conchoidal fracture, and finally, perfect good luck in its manipulation throughout.

The Australian aborigine is often careless in his workmanship. In one of my visits to the late Canon Greenwell, of Durham Cathedral (who had one of the finest private collections of prehistories in the Kingdom), he lifted a roughly-chipped but mounted Australian implement, and said, "If this had not been mounted no collector would have thought of putting it in his bag."

Spencer and Gillen (No. 8, p. 643), state: "Practice at the work is of course

essential, and there are some natives who are more successful than others, but the making of a really good knife is, more or less, a matter of chance, and the endless number of discarded flakes show how long a time is often spent before a suitable one is struck off.'' In another place (No. 8, p. 641) the same authors state, "For every one flake which is considered good enough to use there are, at least, a score discarded." These "rejects," although they do not conform to the ideal standards, are as sure an evidence of human agency as the most finished instrument. Tindale implies, by the use of such terms as ''tend'' and "seldom," that there may be some exceptions to his mathematical standards. But where does he draw the line between the true and the counterfeit?

The collection under discussion consists of 45 specimens. Tindale has selected and figured one of these, which he names a "Plateau Eolith," both of which terms I disown as not used by me and as inappropriate. In his paper he submits this particular example to a kind of micro-analysis, in which he states, "Of the twenty 'primary' flake-scars examined the directions of six conform (within a range of 10°) to the 'normal' for humanly struck blows,'' thus admitting that out of twenty shots blind Nature made six bull's-eyes. I submit that is more than could be expected from an unconscious agent, and is suggestive of design. Of the minor flake scars he states, "Eight deviate from this angle by between 20° and 45°, and the rest lay between 45° and 180°. The actual angles are approximately: 20°, 15°, 35°, 20°, 25°, 40°, 180°, 70°, 60°, 40°, 60°, 50°, 140°." This statement is extraordinary, for an examination of the specimen shows that these minor chippings are practically microscopic and defy all attempts to take measurements of their axes. The tests on which Tindale relied were not intended to be hard and fast rules or to be of universal application. If such meticulous methods were generally adopted half the collections of Europe would have to be thrown on the waste-heap. The regularity of the flaking depends largely on the homogeneity of the stone operated upon, and flint is the most reliable in this respect. The material from which the Central Australian implements were manufactured is mostly desert sandstone. This is a heterogeneous, clastic rock, fine to coarse in the grain, and is held together by a chalcedonic base. Flaking in this material cannot be relied upon for exact and uniform fracture.

With reference to the genuineness of the tableland implements, two of these are specialized forms, while the rest show a definite and uniform style of manufacture. Of the two specialized examples, one of these (14 on p. 214, pl. xix) is a large hand-chopper of the *coup de poing* type, worked to a knob at one end for grasping, and a sharp cutting-edge at the opposite extremity, which is chipped on both sides, as is usual with implements of this class. The other (16 on p. 215, pl. xxi) is a biconvex, quadrate implement, that, at one extremity, has been

shaped to an edge and ground to a smooth surface on both sides, corresponding to the so-called "tomahawk" of the Australian aborigine, the chief difference between the two implements being that while the latter is made from basalt, the tableland implement is formed from desert sandstone, no basaltic rock being available for this purpose.

The remainder of the implements comprise cutting tools, scrapers of different types, points, etc. They possess certain features in common. (*a*) The ventral or under surface is invariably smooth, showing conchoidal fracture in one plane, and frequently a "bulb of percussion." No secondary chippings occur on this face. The particular specimen selected by Tindale for analysis is exceptional, in that its sharp edge has suffered abrasion in one or two places, probably received in the collector's bag. (*b*) The secondary chippings are on the dorsal or upper surface, which forms the working edge of the tool; these chippings are marginal, follow the periphery, and are usually very numerous. How is one to reconcile this uniformity in the flaking of over 40 examples with a fortuitous cause? (*c*) The ferruginous glaze, which is a desert feature, varies in intensity and colour, but is generally a deep red, brown, or almost black. (*d*) With very few exceptions this cortical glaze is as deeply marked on the chipped portions as it is on the natural surfaces. The example figured by Tindale shows the most marked variation, in this respect, of any in the group. This characteristic colouring of the desert varies considerably in different stones, and often in different portions of the same stone, arising from such contingencies as belong to position, partial protection, varying texture of the stone, and the varying susceptibility of the grain for absorbing the ferruginous taint.

Out of the 45 examples on exhibit Tindale has confined his attention to one only, but until he has taken in the whole of the evidence his arguments are worthless. If this particular specimen he challenges fails to stand the test, there are still 44 others to be considered. It is a group exhibit and must be considered as a whole.

To obtain an independent judgment on the genuineness of these Central Australian implements, I sent a copy of my paper to Mr. J. Reid Moir (an authority recognized by Tindale) for his opinion, and asking permission to publish his reply. In response I received the following letter:

Ipswich, 26th September, 1932.

Dear Professor Howchin,

Please accept my thanks for your letter and the reprint of your interesting paper on the Aboriginal Stone Implements of Central Australia. Judging from the photographs of the specimens you describe, I feel that several of them exhibit

human flaking, for example, 3 and 3a, pl. xii (*) ; 1 and 2, pl. xiii; 1, pl. xv; pl. xviii; pl. xix. It is possible that the others you figure also show definite evidence of man's work, but it would be necessary to examine the actual specimens before arriving at a conclusion. Some of the implements appear to me to be of eolithic (Harrisonian) types, while others are later. I am much interested in your views as to the driving out of the Tasmanians from the central tableland. You are quite at liberty to make any use you wish of the remarks I have written about the specimens illustrated in your paper.

With my kind regards,

Yours sincerely,

J. REID MOIR.

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(*) This is the implement that Tindale has figured and condemned.

REVISION OF THE AUSTRALIAN GHOST MOTHS (LEPIDOPTERA HOMONEURA, FAMILY HEPIALIDAE)

PART II.[1]

By NORMAN B. TINDALE, B.Sc., South Australian Museum.

Fig. 1-92.

Oncopera Walker.

Oncopera Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1558.
Oncoptera Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1124.
Oncopera Eyer and Turner, Proc. Linn. Soc. N.S. Wales, i, 1925, p. 272.

Antennae of few segments, usually from fourteen to twenty, very short, less than one-sixth length of forewing, almost cylindrical, either swelling gradually towards the apex to form a club, or filamentous; a tuft of hairs on the basal segment projects over the eyes. The labial palpi only moderately developed, slender, projected straight forwards, concealed in dense hairs, the maxillary palpi short, obsolete, and concealed. Males with hind tibiae with large curved tuft of hairs arising from an expansion of the margin. Veins R_4 and R_5 of forewings stalked either before, at, or after radio-median cross-vein. Vein M_1 of hindwings forms a distinct Y-fork with radio-median cross-vein.

Genotype: *O. intricata* Walker, 1856.

Members of this genus are easily distinguishable from all other genera of the family by the short subclavate or filamentous antennae and by the tibial hair-tufts of the males. At least twelve species are known. They range from Tasmania northward to Kuranda in North Queensland and westward as far as Mount Gambier in South Australia. Most of the species are grass feeders in the larval state and are potentially harmful to pastures. At least two species, *O. mitocera* on the Atherton Tableland and *O. intricata* in Tasmania are major farm pests. Other species have been recorded as injuring grazing lands in the wetter parts of Victoria.

The distribution of the members of the genus (fig. 1) lies entirely within the belt of thirty-inch annual uniform rainfall, and each species appears to be re-

(1) Part I, published in Rec. S. Aust. Mus., iv, 1932, pp. 497-536.

stricted within relatively narrow general limits of climate. That temperature is an important factor seems to be confirmed by the study of the range of *O. alboguttata* which occurs near sea-level at Sydney at the southern end of its range, again at some elevation in the Dorrigo district, about three hundred miles further north, and at 3,000 feet in the National Park in southern Queensland.

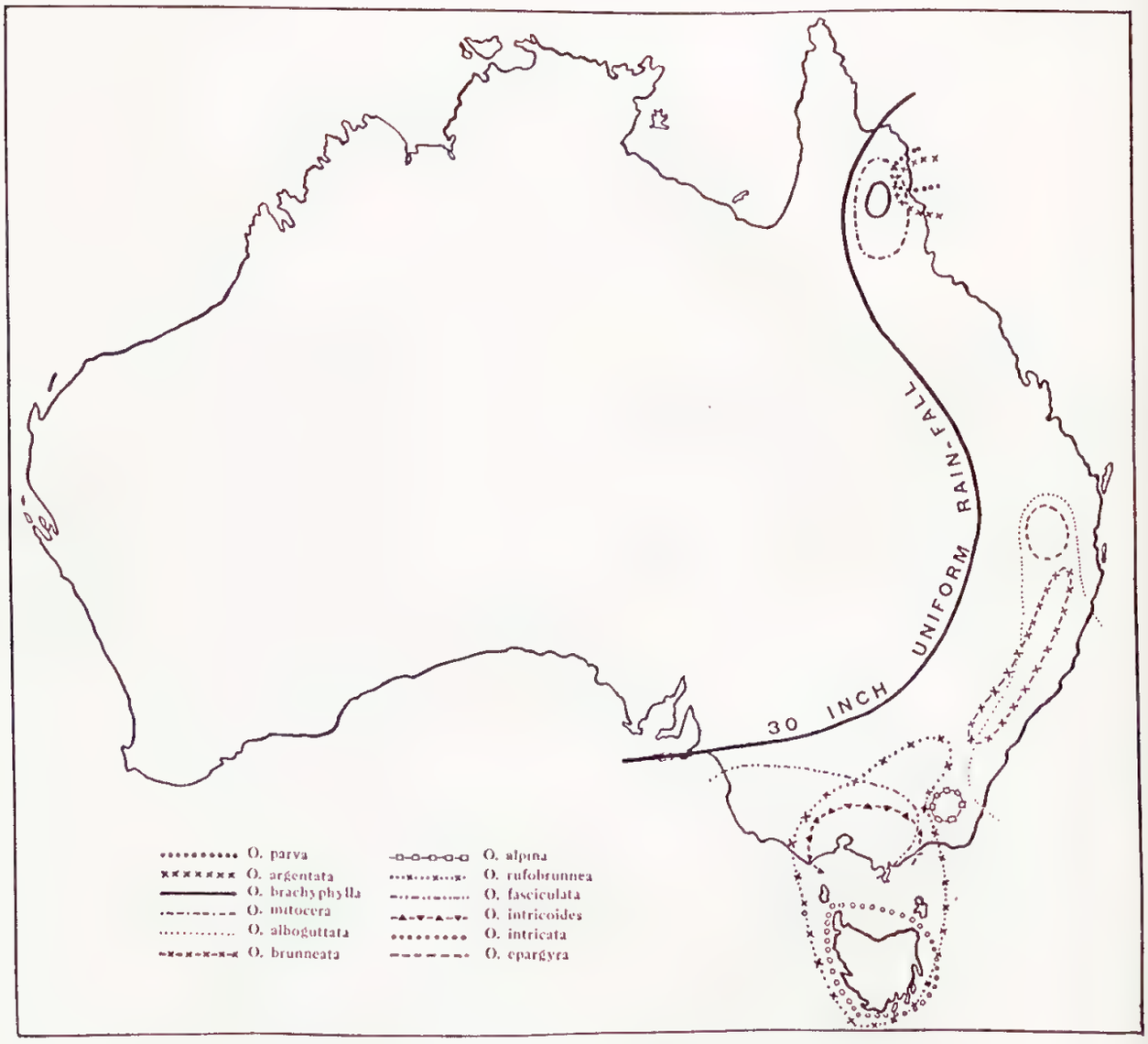

Fig. 1. Distribution of the species of *Oncopera*.

Four species appear to be present on the Atherton Tableland; two of them have been described from unlocalized specimens labelled "Cairns District," but it appears probable that they were not collected on the lowlands.

The presence or absence of a sacculus in the male genitalia might be used to divide the genus into two sections, (a) a northern one embracing *O. mitocera*, *O. parva*, *O. argentata* and *O. brachyphylla* and (b) a southern one containing the

other seven species. *O. parva*, *O. argentata*, and *O. brunneata* are linked by the common possession of specialized white scales on the undersides of the hindwings. The form of the eighth sternite tends to link *O. mitocera* and *O. brunneata*, species otherwise quite apart.

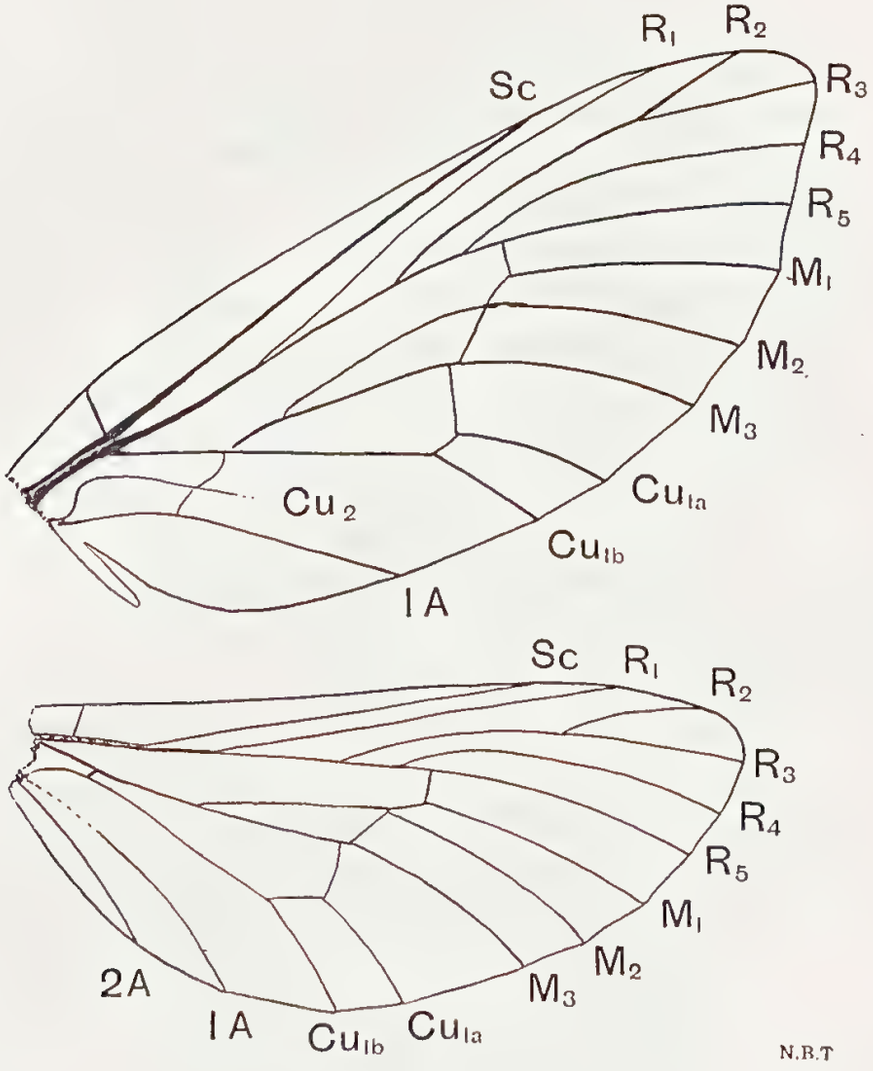

Fig. 2. *Oncopera fasciculata* (Walker) Venation, male.

The form of the antennae provides a natural subdivision of the genus. Clavate antennae are characteristic of the typical subgenus (with *O. intricata* as type); this contains all of the southern species (Victoria, Tasmania and alpine New South Wales) *O. fasciculata*, *O. alpina*, *O. intricoides*, and *O. rufobrunnea*.

The subgenus *Paroncopera* subgen. nov. (with *O. mitocera* as type) contains the other seven species, including *O. alboguttata*, *O. brunneata*, *O. brachyphylla*, *O. parva*, *O. argentata*, and *O. epargyra*. They are characterized by possessing filamentous antennae, usually clothed with large flattened scales.

O. albofasciata, in the sum of its characters probably stands as the most

generalized member of a specialized genus; it has links on the one hand with *O. brachyphylla* and *O. mitocera* and also, somewhat less obviously, with the typical subgenus.

Philpott (2) figured as characteristic of the genus the venation of an example of *O. mitocera* in which R_4 of forewing forks with R_5 distally from the radio-median cross-vein. This must be exceptional even within the species, for in twenty-two out of twenty-three examples examined for this character, it appears to branch at the cross-vein. The character may be a variable one for in *O. albo-guttata* the fork may be either before, at, or well after the cross-vein. In all members of the typical subgenus and in *O. brunneata*, however, the forking is well before that vein.

For the detailed study of the members of this genus genitalia preparations are useful. Owing to its lower refractive index choral hydrate is preferable to balsam as a temporary mounting medium. Type preparations should be subsequently remounted in balsam for permanent storage. The characters of the vinculum, harpe, tegumen and eighth sternite are of special importance. The juxta is often not well chitinized and is difficult to examine without dissection. In O. *intricoides* and *O. rufobrunna* it is folded down so as to appear transverse. In *O. alpina* this does not appear to happen. When detached it is seen to be broadly concave on the posterior margin in the last-named species, with an obscure median notch. In the two former species it is then longer than wide, slightly convex on posterior margin, which bears an acute median notch.

For material for the study of the members of this genus I am particularly indebted to Messrs. G. F. Hill and A. Tonnoir, of the Entomological Division, C.S.I.R., and to Mr. C. G. L. Gooding, of Moe, who made special collections.

KEY TO THE SPECIES OF ONCOPERA.

(based on male genitalia)

a. Sacculus absent (a saccular lobe sometimes present).
  b. Vinculum with heavily chitinized portion wider than long .. .. *intricata*
  bb. Vinculum with heavily chitinized portion longer than wide.
    c. Harpe with shaft neither dilated nor strongly bent at one half.
      d. Tegumen with mesal processes broadly triangular, acutely terminated, marginal armature almost obsolete .. .. *fasciculata*

(2) Philpott, Trans. Ent. Soc., Lond., 1925, pl. lii.

dd. Tegumen with mesal processes not broadly triangular, but blunt-pointed and armed with conspicuous marginal denticles.
e. Denticles of tegumen acute.
f. Juxta with ventral margin not broadly concave.
g. Eighth sternite with protuberance obsolete .. .. *rufobrunnea*
gg. Eighth sternite with well-developed protuberance .. .. *intricoides*
ff. Juxta with ventral margin broadly concave .. .. *alpina*
ee. Denticles of tegument rounded .. .. *alboguttata*
cc. Harpe dilated and strongly bent at one half .. *brunneata*
aa. Sacculus present.
h. Sacculus short .. .. *brachyphylla*
hh. Sacculus long.
i. Tegumen unarmed.
j. Base of harpe slender .. .. .. *parva*
jj. Base of harpe broad.
k. Cucullus dilated apically .. .. *argentata*
kk. Cucullus not dilated apically .. *epargyra*
ii. Tegumen armed with denticles .. .. *mitocera*

KEY TO THE SPECIES OF ONCOPERA

(based on general characters).

a. Forewings with an inner marginal fascia.
b. Forewings with dull white markings forming a subreticulate pattern.
c. Males.
d. Hindwings with ciliae not unicolorous.
e. Abdomen and legs light fuscous .. .. *intricata*
ee. Abdomen and legs dark brown .. .. *alpina*
dd. Hindwings with ciliae unicolorous .. .. *intricoides*
cc. Females.
f. Wings broad .. .. *intricoides*
ff. Wings narrow.
g. Markings obscure .. .. .. *intricata*
gg. Markings well defined .. .. .. *fasciculata* / *alpina*
bb. Forewings without dull white markings; males .. *fasciculata*
aa. Forewings without inner marginal fascia.
h. Antennae clubbed.
i. Forewings brown; male.. .. .. .. *rufobrunnea*
ii. Forewings grey; female .. .. .. *rufobrunnea*
hh. Antennae not clubbed.

j. Males.
k. Hindwings beneath with dense silvery-white scales on posterior half.
l. Forewings with oblique ochreous-brown fascia from apex to two-thirds inner margin .. .. *brunneata*
ll. Forewings without oblique fascia.
m. Hindwings above with silvery-white scales .. .. .. *argentata*
mm. Hindwings above without silvery-white scales .. .. .. *parva*
kk. Hindwings beneath without silvery-white scales.
n. Forewings pointed at apex .. .. { *alboguttata* / *epargyra*
nn. Forewings not pointed at apex.
o. Forewings short and broad .. *brachyphylla*
oo. Forewings not short and broad .. *mitocera*
jj. Females.
p. Expanse less than 45 mm. .. .. { *brunneata* / *parva*
pp. Expanse greater than 45 mm.
q. Forewings with numerous obscure ocellate markings of small size *alboguttata*
qq. Forewings without numerous obscure ocellate markings .. *mitocera*

ONCOPERA INTRICATA Walker.

Fig. 3-11.

Oncopera intricata Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1559.
Oncoptera intricata Meyrick, Proc. Linn. Soc., N.S. Wales, iv (2), 1889, p. 1124.
Oncopera intricata Hill, Australian Council for Sci. and Indust. Research, pamphlet 11, 1929, pp. 1-43, 1 plate (bionomics).

♂ Antennae short, subclavate, usually of nineteen segments, club apical, twice as wide as shaft, yellowish-brown; palpi with median segment relatively long and slender, more than twice as long as apical one; thorax dark fuscous; head, abdomen, and legs light fuscous; tuft of hairs on posterior tibiae very dense, light ochreous-brown in colour. Forewings hyaline, dark greyish-brown with a conspicuous intricate pattern of greyish-white lines obscured by ochreous and fuscous linear marks; beneath grey without pattern. Hindwings hyaline, dark grey, basal two-thirds of costal margin pale ochreous; ciliae white with darker transverse line, veins dark grey. Beneath with apex of wings densely, elsewhere more scantily pubescent. Expanse, 37 mm.

♀ Head, thorax, and abdomen slightly more fuscous than in male. Fore-

wings narrow and elongate, markings as in male but somewhat obscured. Hindwings rather uniformly dark grey, costa very narrowly ochreous. Expanse, 46 mm.

Loc. Tasmania: Scottsdale 1; Hobart 1; Snug River; Launceston 2. 19 males, 9 females.

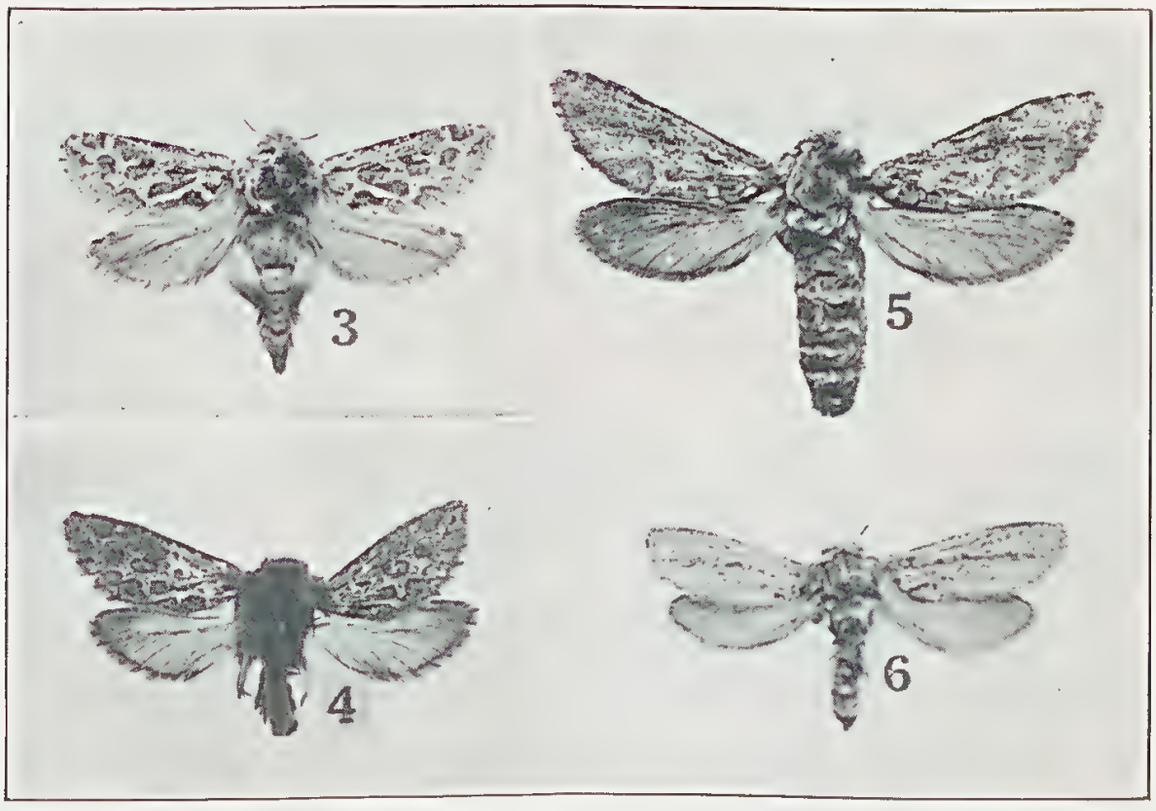

Fig. 3–6. *Oncopera intricata* (Walker). Left side: 3. male, Launceston; 4. type, a male, Tasmania (in British Museum). Right side: 5, female, Scottsdale; 6, female, Scottsdale.

The described male example (fig. 3) was taken at Launceston (February 7, 1902). It compares well with Walker's type example (fig. 4) in the British Museum. The latter came from Van Dieman's Land, and is one of sixteen examined by him. The female (Scottsdale, January 31, 1927) described and figured is of normal form and size (fig. 5); the other example is a dwarfed one taken at the same locality a year later (January 30, 1928).

The male genitalia have the vinculum wider than long, with the median process distinctly transverse. The tegumen has the caudal margin produced into a broad fold; the mesal processes are armed with sharp saw-like teeth. The harpe is without a sacculus, relatively broad, curved and rounded at apex; it is well clothed with specialized hairs, short at apex, stout at base. The 8th sternite is rectangular and without a spine or protuberance.

The genitalia figured by Eyer and Turner (Proc. Linn. Soc. N.S. Wales, 1, 1925, pl. xxxii, fig. 1) may belong to this species, but the form of the tegumen and the spine-like anal process are not in close agreement with any examples examined. Dr. Turner has been unable to give me details of the provenance of their specimen.

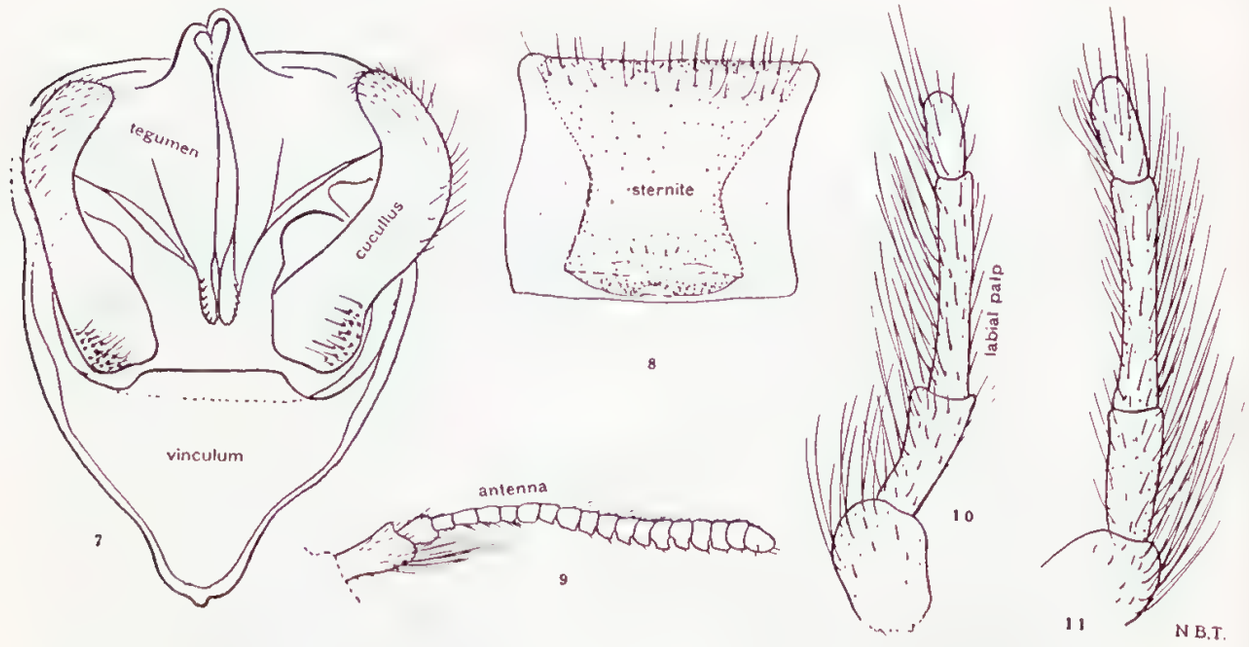

Fig. 7–11. *Oncopera intricata* (Walker). Scottsdale. 7. male genitalia; 8. eighth sternite; 9, antenna; 10–11, palpi showing range of variation.

O. intricata is readily distinguishable from all the other species of the genus by the broad vinculum of the male, with its transverse median process, also by the compactness of the tibial hair-tufts and the short, broad wings. The females have relatively long, narrow wings bearing marked traces of the male wing-pattern.

There is only one other known Tasmanian species, *O. rufobrunnea*, from which it is easily distinguished by its small size, short wings, and whitish reticulated markings.

This species is a serious pest of the grasslands of Tasmania. On mixed farming land it attacks permanent sown pastures, which normally become available in the second year after planting, and remain profitable for from eight to twenty years. Under the present conditions such pastures are depleted of their best grasses in the second and third years and are destroyed in the fourth.

The adult emerges between the last week of January and the middle of February. The life-cycle and the habits of the adults have been described by Hill, who has also published an account of experiments on methods of control.

ONCOPERA FASCICULATA (Walker).

Fig. 12-19.

Hepialus fasciculata Walker, Char. Undesc. Lep. Het., 1869, p. 68.
Oncoptera intricata Turner, Mem. Nat. Mus. Melb., 4, 1912, p. 18.

♂ Antennae subclavate, widest before apex, usually of 14–15 segments, apical segment slightly produced, palpi with median segment stout, less than twice as long as third, apical segment long. Head, thorax, abdomen, and legs ochreous-brown. Forewings bright opaque ochreous-brown with obscure darker infuscations; a submarginal white streak from near one-fifth inner margin bordered above with ochreous and below with black, forewing beneath ochreous-fuscous. Hindwings opaque, greyish-brown, with costa tinged ochreous from base to apex, beneath fuscous. Expanse, 44 mm.

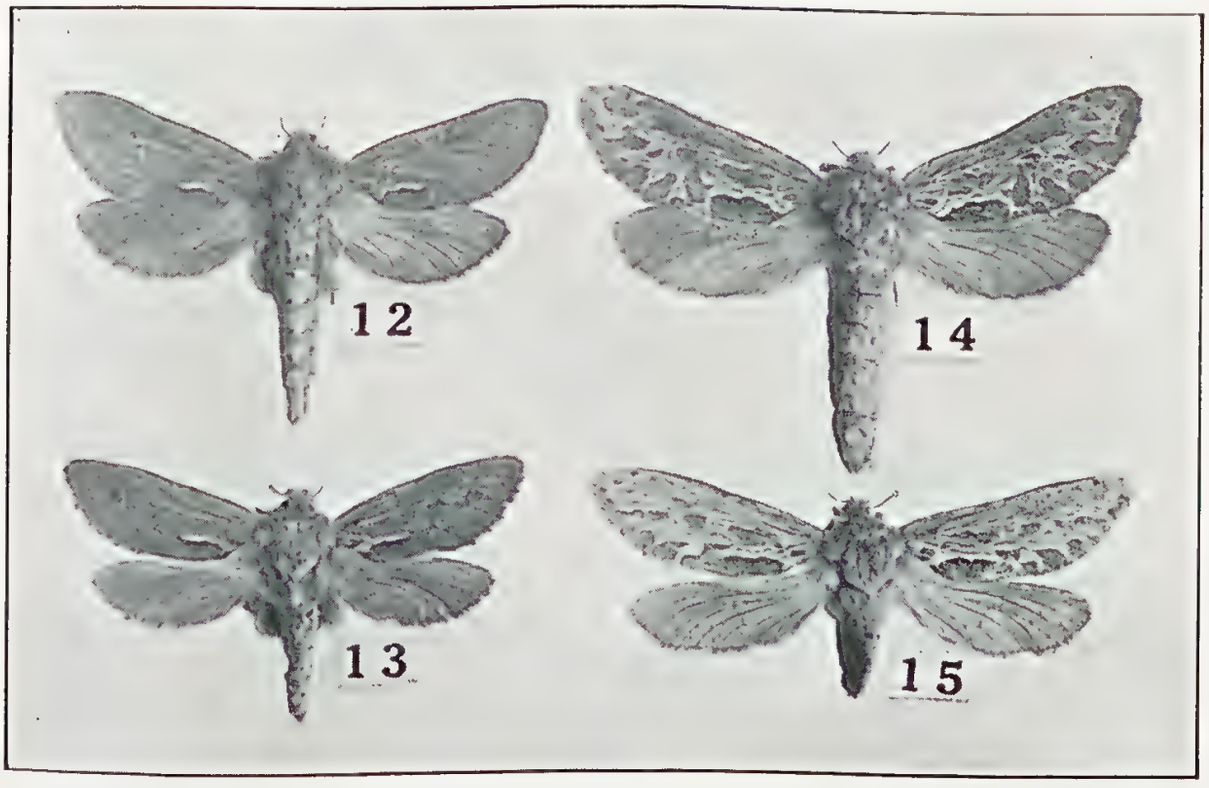

Fig. 12–15. *Oncopera fasciculata* (Walker). 12, male, Moe; 13, male, Gisborne; 14, female, Moe; 15, female, Gisborne.

♀ Head and thorax grey, abdomen slightly paler. Forewings opaque, obscurely brownish-black with a well-developed intricate pattern of ochreous marks margined with greyish-white; a conspicuous streak at one-fifth inner margin, as in male. Hindwings grey. Expanse, 50 mm.

Loc. Victoria: Moe 10; Gisborne 10; Leongatha 10; Caulfield; Melbourne; Packenham.

South Australia: Yahl Paddock near Mount Gambier 9. 50 males, 31 females.

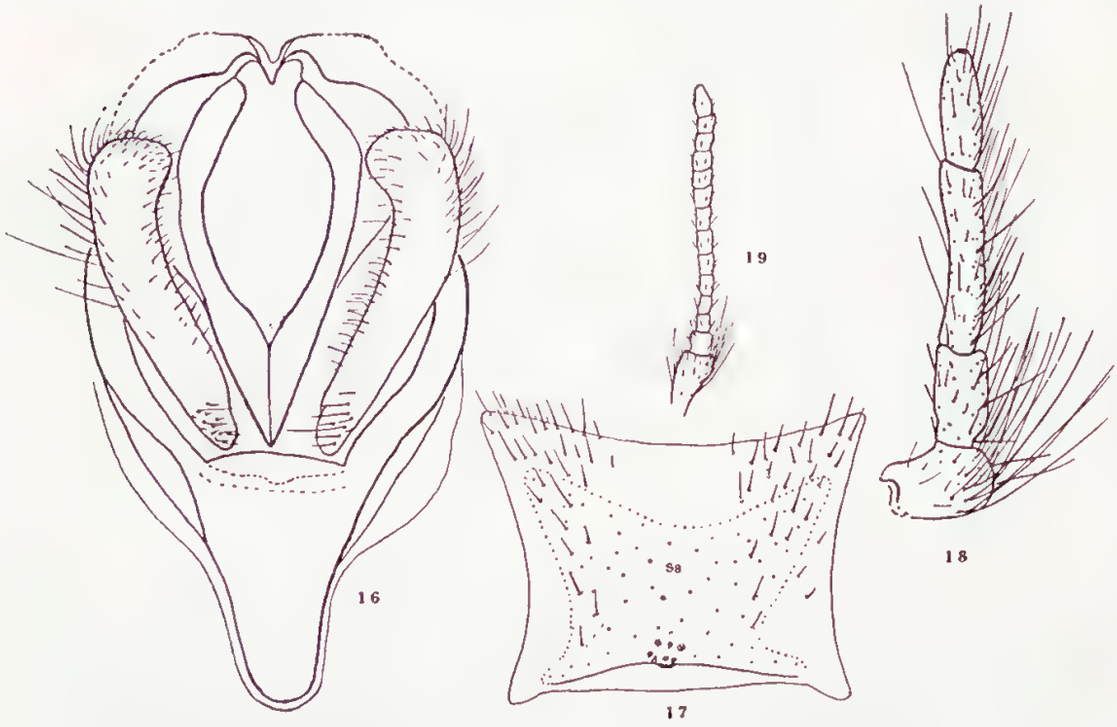

Fig. 16–19. *Oncopera fasciculata* (Walker). 16. male genitalia; 17. eighth sternite; 18, labial palp; 19. antenna.

The male and female examples described and figured are both from Moe (October 9, 1929), and are typical of long series from the same locality. Walker's type, in the National Museum, which is a male (not a female as described), agrees closely with the male described above. The other pair figured are from Gisborne (October 19, 1922, and October 11, 1895). The male is somewhat darker and female lighter than usual.

The male genitalia are characterized by the long, slender vinculum, somewhat variable, but often twice as long as wide; this bears a feebly convex median process. The mesal processes of the tegumen are broadly triangular and acutely terminated, without or at most with obsolete armature; in lateral view the mesal process is broad and strongly convex on posterior margin. The harpe is simple, the apex slightly swollen, truncated, and sub-rectangular, a slight swelling or carina may be present in the position of the sacculus of some other species of the genus. The juxta, usually not well chitinized, is apparently transverse in ventral view. The eighth sternite bears a small hollow protuberance. In two unlocalized examples, typical in general appearance, the vinculum is as wide as in normal *O. rufobrunnea.*

Mr. C. G. L. Gooding made systematic collections of this moth at Moe in October, 1929, and his results indicate that the first examples emerged on October 4. Males were then much more abundant than females. Males swarmed on the 7th and 9th. On the former night females were absent, or rare, but on the 9th they outnumbered the males. Isolated female examples were captured on the 12th and 15th, and males on the 16th. From this it appears that the emergence period is a limited one. At Gisborne, in 1895, females emerged on October 11, in 1922 males were taken abundantly on October 19 and sparsely on the 23rd.

One pair of this species in the Lyell collection bears erroneous date labels, indicating January 15, 1920, as the time of capture. Mr. Gooding, in 1928, suspected that he had made an error in dating these, and by intensive collecting proved that the January form from the same locality is a distinct species.

ONCOPERA RUFOBRUNNEA sp. nov.

Fig. 20-32.

♂ Antennae weakly subclavate, widest before apex, clothed with fine, scattered, semi-erect hairs, usually seventeen-segmented, ochreous-brown; palpi with second segment stout, third segment ovate. Head, thorax, and abdomen ochreous fulvous, tibial plumes somewhat lighter. Forewings hyaline, broad, dull reddish-brown with obscure darker infuscations, beneath grey. Hindwings grey, costal margin rather broadly ochreous. Expanse, 47 mm.

♀ Head, thorax, and abdomen fulvous. Forewings broad, hyaline, rather uniformly fulvous, with numerous small, obscure, darker marks. Hindwings hyaline, uniformly grey. Expanse, 57 mm.

Loc. New South Wales: Lee Creek, F.C.T., 11, 12. Moe 1, 11, 12 (January 18 and 16, 1930, C. G. Gooding, type, a male, and allotype female, I. 18670, in S. Aust. Mus.); Healesville 12; Leongatha 12; Hawthorn 11, 12; Dandenong Range 12; Toora 12; Gisborne 12; Geelong; Caulfield; Meeniyan 2. Tasmania: Tyenna 12; Hobart 12; Maria Island 12. 129 males, 41 females.

The type pair were taken in company with many others. The second pair figured are from Gisborne, captured on December 16, 1912. The wings of the Gisborne male are more ochreous in colour, the infuscations are less conspicuous, and the ochreous costal margin is broader. The female is lighter in colour. The third pair figured are Tasmanian; the male from Hobart in December, 1927, the female from Tyenna, December 8, 1929. The fourth pair shown are a very dark-coloured male from Moe (January 11, 1930) and a female from Hawthorn November 28, 1927). The latter emerged, before 7.45 p.m., from a buffalo-grass lawn.

The male genitalia have the vinculum longer than wide and posterior margin strongly and evenly convex. Tegumen with mesal processes blunt-pointed, armed with conspicuous medially directed acute denticles (fig. 29); the ventral margin

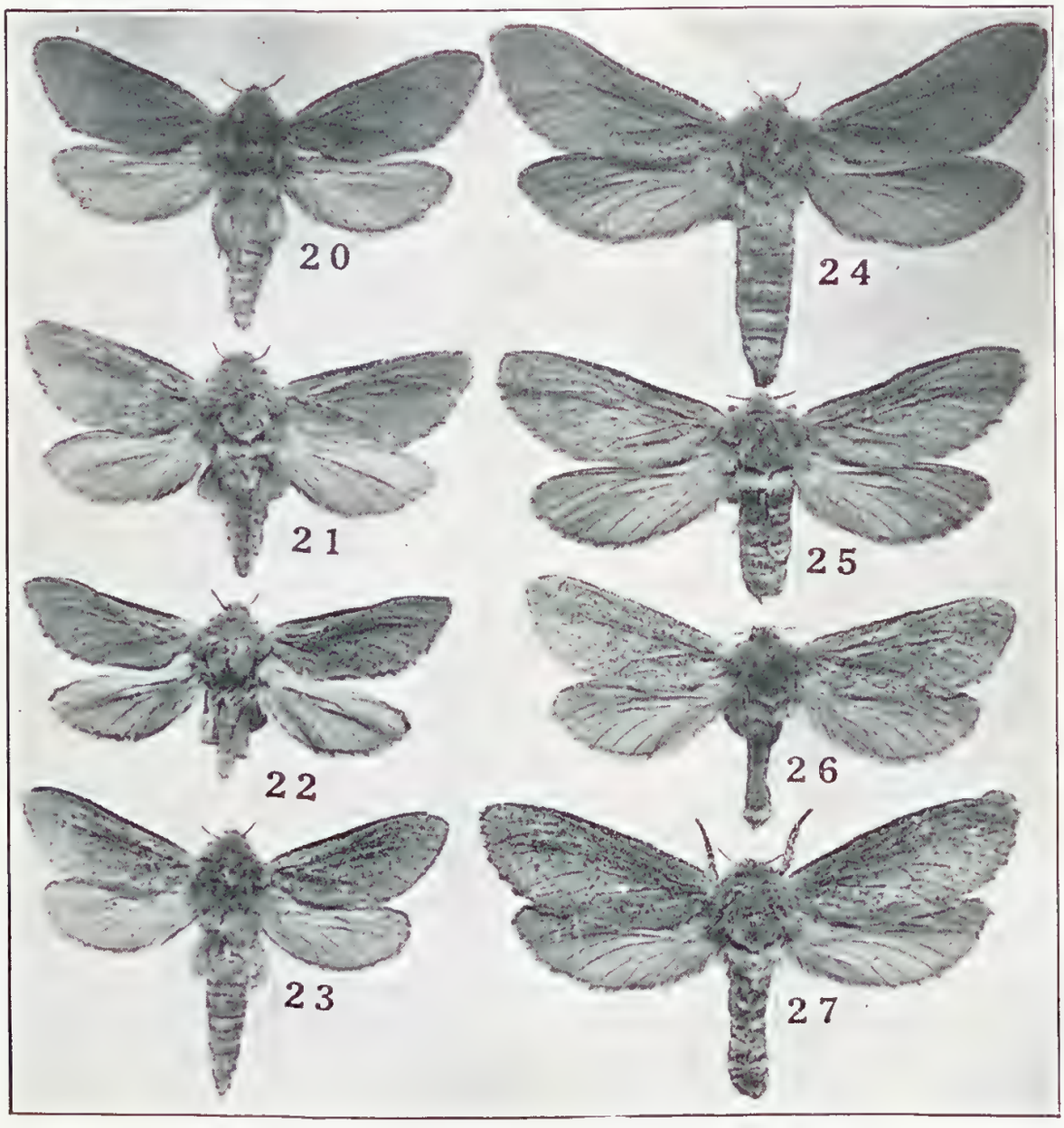

Fig. 20–27. *Oncopera rufobrunnea* sp. nov. 20. type, a male, Moe; 21. male, Gisborne; 22. male, Hobart; 23. male, grey form, Moe; 24. allotype female, Moe; 25. female, Gisborne; 26. female, Tyenna; 27. female, Hawthorn.

is well chitinized. Harpe in ventral view evenly curved, slightly swollen at apex, in lateral view broadly flattened towards base; juxta transverse; not well chitinized at lateral margins. The eighth sternite has the margin without or at most with an obsolete hollow protuberance.

One aberrant male example bears a small sacculus on one harpe; this is absent on the other valve. The genitalia figured are from an example from Hobart.

Mr. G. Lyell states that males of this species occasionally come to lights at night. The species is probably the most common one in eastern Victoria, and its range extends to Maria Island and Tasmania.

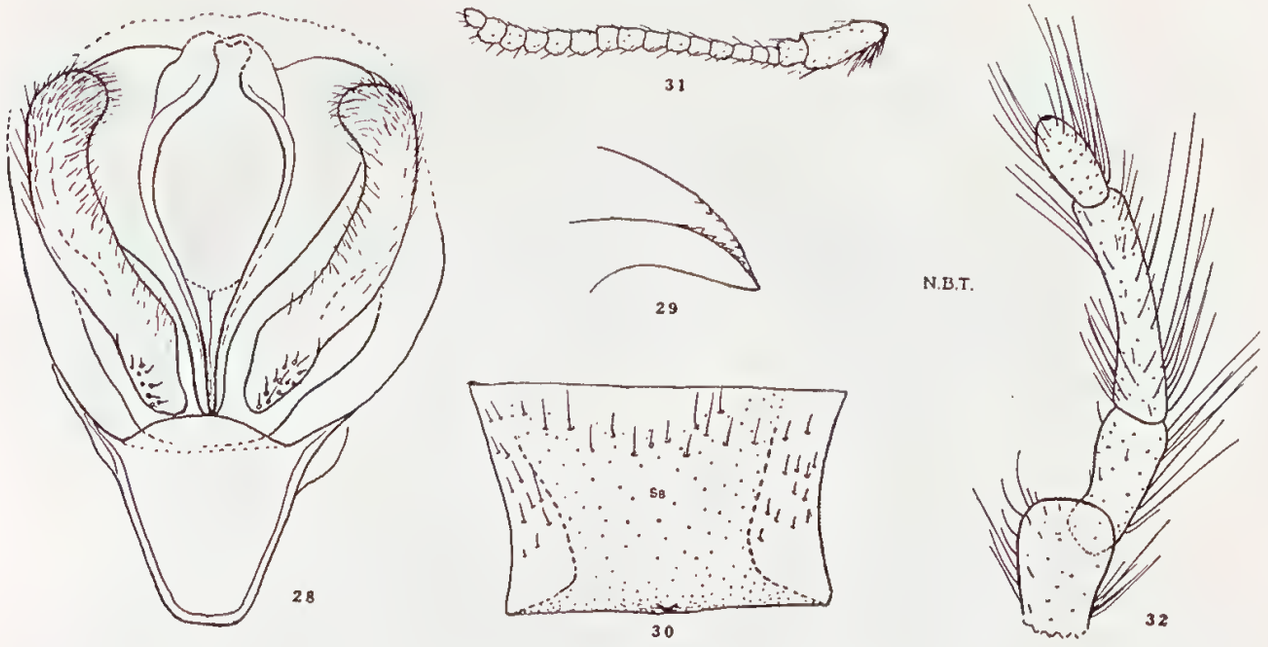

Fig. 28–32. *Oncopera rufobrunnea* sp. nov. 28. male genitalia, Hobart; 29. oblique view of tegumen; 30. eighth sternite, Moe; 31. antenna; 32. labial palp.

Mr. G. F. Hill reared both sexes of the species at Leongatha and Hawthorn. Several pupal shells have been examined, but owing to the absence of adequate comparative material have not yet been described. The mask may eventually be proved to give useful characters for the separation of the pupae of the different species.

ONCOPERA INTRICOIDES sp. nov.

Fig. 33-39.

♂ Antennae with club long compared with shaft, a very sparse clothing of sub-erect hairs, a basal tuft of very long hairs; usually composed of sixteen segments; apical segment twice as long as penultimate; palpi moderate, third segment long, truncated at apex, densely clothed with long hairs; head, thorax, abdomen, and legs dark-brown, tibial hair-tufts of posterior legs paler. Forewings rather broad, opaque, dark-brown with black scales, with irregular pattern of ochreous scales obscurely margined with greyish-white; traces of an irregular fascia near base of inner margin bordered posteriorly with black; beneath pale grey without pattern. Hindwings rather uniformly dark-brown except near apex. Expanse, 42 mm.

♀ Forewings rather broad, opaque, the pattern similar to male; the fascia near base of inner margin is somewhat less conspicuous. Hindwings greyish-brown, at costa narrowly yellowish; ciliae between veins tipped with dull white, at veins dark brown. Expanse, 56 mm.

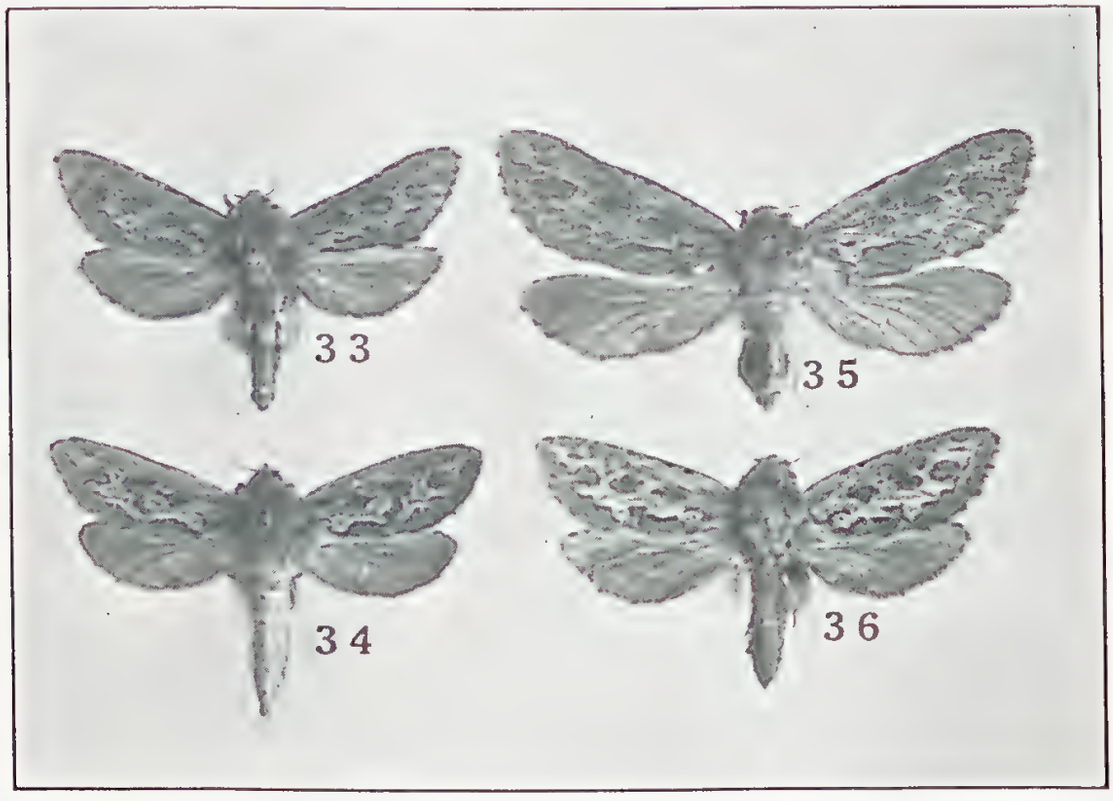

Fig. 33–36. *Oncopera intricoides* sp. nov. 33. type, a male, Moe; 34. male, Moe; 35. allotype female, Moe; 36. female, Moe.

Loc. Victoria: Moe 1, 11, 12 (December 28, 1920, C. G. L. Gooding, type, a male, and allotype female, I. 18671, in S. Aust. Mus.); Leongatha 12; Narracan 11; Caulfield; Toora 12. 25 males, 5 females.

The male genitalia have the vinculum longer than wide; the posterior margin is convex. The tegumen has the mesal processes narrow, long, and blunt-pointed, the ventral margin armed with moderately conspicuous acute denticles; the ventral margin is well chitinized. The harpe in ventral view is long and narrow, rather strongly curved and somewhat truncated at apex, a feeble ridge indicated by a line of hairs from base to two-thirds; juxta apparently transverse, posterior margin with a median notch. The figure of the genitalia is drawn from an example from Leongatha (December 15, 1927). In many examples the denticles of tegumen are absent from the margin for a short distance from the apex.

The type pair were taken together. Dates of capture of the series examined suggest that this insect is most abundant between December 15 and 30, and that

its emergence is limited to a few suitable nights during that period. Males continue to emerge in January, and at Moe in 1930 a series was taken on the 20th. In 1932 a male was captured at Moe as early as November 29.

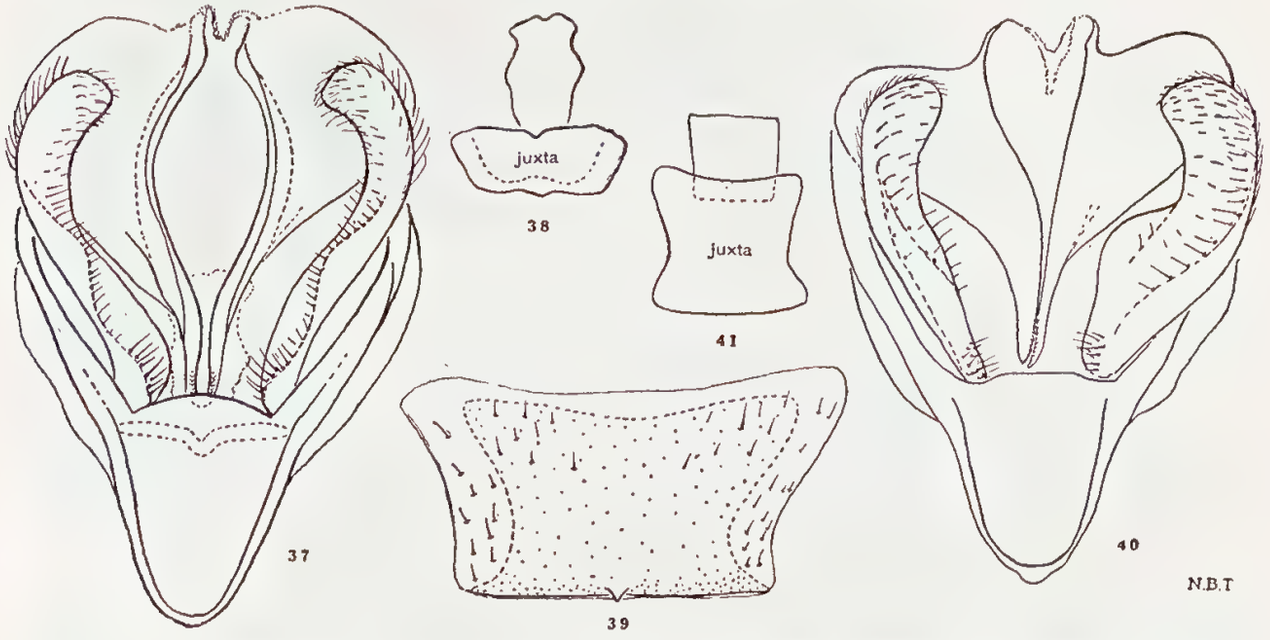

Fig. 37–41. 37–39. *Oncopera intricoides* sp. nov., male genitalia, Leongatha; 38. juxta and trulleum; 39. eighth sternite. 40–41. *O. alpina* sp. nov. 40. male genitalia; 41. juxta and trulleum.

The status of this form has been difficult to determine. Its range extends over part of that of *O. rufobrunnea,* it occurs at about the same season of the year and in the same general districts. It is much rarer than that species. Mr. C. G. Gooding considers that the larvae may be found to thrive under different soil conditions; he has noticed that some larvae occur on well-drained hillsides in sandy soil, others on the stiffer soil of the valley bottoms. In general appearance it is quite distinct from *O. rufobrunnea.* The abundantly marked wings, the submarginal fascia on hind margin of forewings, and the similarity of the sexes are well-marked characters, but the male genitalia indicate rather close relationship. The presence of a marked protuberance on the eighth sternite is a distinct difference; in *O. rufobrunnea* this is normally absent, but in a long series intergradations may occur, for there is an example in the series with a small but distinct process. An aberrant example from Moe (November 29, 1932) has the vinculum divided by a rounded anterior notch into two lobes.

ONCOPERA ALPINA sp. nov.

Fig. 40-47.

♂ Antennae short, clubbed, usually of fifteen segments, clubbed portion long, one and a half times as wide as shaft, apical segment small, as wide as long;

ochreous, densely clothed with flattened scale-like hairs. Palpi stout, median segment two and a half times as long as third, the latter sub-rectangular and more than twice as long as wide. Head, thorax, abdomen, and legs dark brown. Forewings opaque, dark brown with darker suffusions; a well-defined, irregular pattern of pale ochreous marks bordered with darker ochreous and creamy-white scales, sub-marginal fascia near base of inner margin well developed. Ciliae ochreous, at veins dark brown; wings beneath clothed with uniform grey hair-like scales. Hindwings greyish-brown, costa from base to apex pale ochreous; ciliae pale ochreous, at veins greyish-brown. Expanse, 38 mm.

♀ Antennae similar to male, pale ochreous; head, thorax, abdomen, and legs pale ochreous-grey. Forewings dark grey with greyish-white pattern similar to that of male. Hindwings grey, paler near base. Expanse, 41 mm.

f. nebulosa form nov. Similar to typical form. Forewings dull ochreous-brown with the markings obscured. Hindwings as in typical form. Expanse, 38 mm.

Loc. New South Wales: Mount Kosciusko 12 (December 7, 1922, G. M. Goldfinch; type, a male, in Goldfinch collection; allotype female, at 5,000 feet, December 3-10, 1921, I. 18672, in S. Aust. Mus.). 8 males, 1 female.

f. nebulosa. Mount Kosciusko, 5,000 feet, 12 (type, a male, I. 18673, in S. Aust. Mus.). 3 males.

The series examined were all taken by Messrs. G. M. Goldfinch and A. J. Nicholson at 5,000 feet on Mount Kosciusko, between December 3 and 10, 1921, and on December 7 of the following year.

Associated with the typical examples were several males with the forewing markings obscured and suffused with ochreous-brown, thus resembling in general appearance dwarfed examples of *O. rufobrunnea.* In the structures of the genitalia they agree closely with typical *O. alpina,* and can therefore be treated only as a form or variety.

Mr. Goldfinch writes with regard to this species: "I have no doubt that the various forms represent only one species. They were all taken at the lights on the verandah of the hotel, but I have found examples hiding for shelter under bark and logs in cold weather. Empty pupal cases which, I have little doubt, belong to this species are not infrequently seen projecting from tufts of snow grass."

The male genitalia have the vinculum longer than wide; the posterior margin is transverse or very slightly rounded. The tegumen has the ventral margin unfolded and relatively lightly chitinized, the downward tilt of the posterior portion, as viewed from the ventral aspect, causes it to appear like an anal spine or process; the mesal processes are blunt-pointed and armed with conspicuous marginal acutely-pointed denticles. The harpe is without a sacculus and is relatively

broad and evenly curved; the apex is slightly inflated and truncated. The juxta is as wide as long; the lateral margins are concave. The trulleum is rectangular.

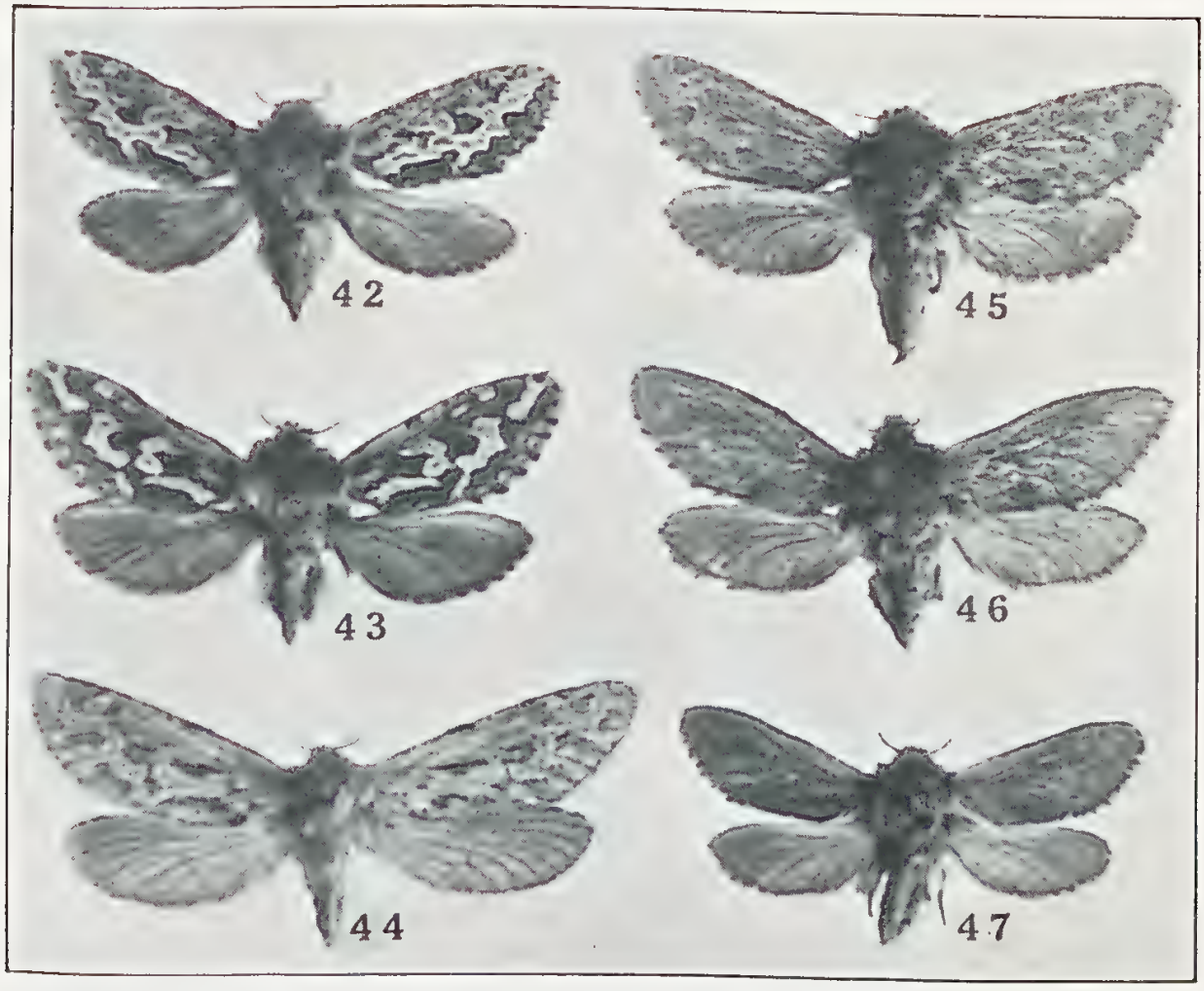

Fig. 42–47. 42–44. *Oncopera alpina* sp. nov. 42. male; 43. type, a male; 44. allotype female. 45–47. *O alpina* f. *nebulosa* form nov. 45. type, a male; 46–47. males, Mt. Kosciusko.

The genitalia figure is drawn from the type example. Eyer and Turner's figure (*loc cit.*, pl. xxxii, fig. 1), ascribed to *O. intricata,* may have been based on an example of this species. The posterior portion of the tegumen appears from certain aspects to be like a true anal process. Dr. Turner has been unable to trace details as to the locality of his dissected specimen, so that the matter is inconclusive.

The species differs from *O. intricata* in the form of the vinculum of the male and in the colour of the body and wings. From *O. rufobrunnea* it is distinguished by the presence of a marked submarginal fascia near base of inner margin. From male *O. intricoides* it differs in the smaller size, the varicoloured ciliae of hind-wings, and the form of the juxta and tegumen. The female *O. intricoides* is larger and has broader wings.

ONCOPERA (PARONCOPERA) ALBOGUTTATA sp. nov.

Fig. 48-60.

Oncopera mitocera Turner, Proc. Linn. Soc. N.S. Wales, 1, 1925, p. 272, pl. xxxii, fig. 2 (*nec* Turner, 1911).

♂ Antennae short, not markedly clubbed, brown, usually eighteen-segmented, a long tuft of hairs at base. Head, thorax, and legs brown, abdomen greyish-brown. Forewings pointed, almost subfalcate, pale brown with small

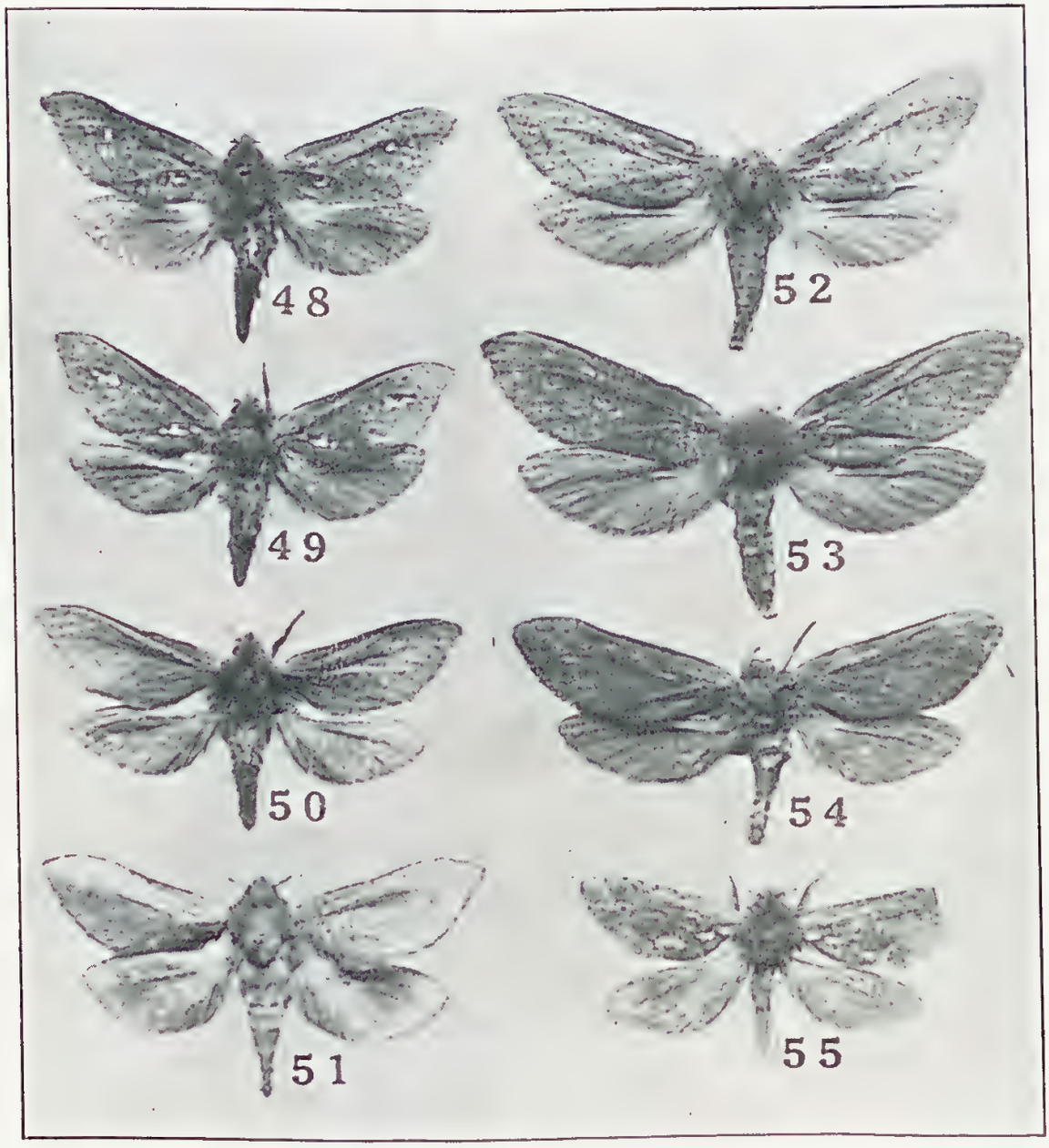

Fig. 48–55. *Oncopera alboguttata* sp. nov. 48. type, a male, Killara; 49. male, Killara; 50. male, reddish ochreous form, Killara; 51. male, National Park, Queensland; 52. allotype female, Killara; 53. female, Killara; 54. female, Killara; 55. male, National Park, Queensland.

irregular spots of darker colour; a group of three submarginal greyish-white spots near one-third inner margin partly surrounded by black scales, a group of two similar discoidal spots near base of M_1; beneath grey. Hindwings grey, apex broadly and costa narrowly brown as on forewings, base white. Expanse, 40 mm.

♀ Forewings less acute at apex than in male, termen strongly rounded, pale brown with very scattered darker flecks. Traces of markings near one-third inner margin, also indications of subterminal and discoidal dark brown marks. Hindwings as in male, base of wings dull greyish-white. Expanse, 48 mm.

Loc. New South Wales: Killara 2 (February 12, 1928, G. A. Waterhouse, type, a male, and allotype female, February 26, 1928, I. 18674, in S. Aust. Mus.); Ash Island; Deer Vale 1; Dorrigo 1, 2. Queensland: National Park (3,000 feet) 1, 12. 23 males, 7 females.

The pair described above are very typical. Both sexes are variable. Fig. 50 depicts a male example from Killara (February 12, 1928), taken with the type, in which the markings are almost obsolete and the head, thorax, and forewings are bright reddish-ochreous. Such ruddy examples are common at Dorrigo. In other male examples (fig. 51) the ground colour remains as in the typical form, but the white marks become obsolete. Some females (fig. 53-54) are heavily infuscated; in such cases the tiny fleck-like spots may stand out as dark-centred brown ocelliform marks.

Male genitalia with vinculum longer than wide; the marginal and less heavily chitinized portion sometimes broad; posterior margin strongly and evenly convex. Tegumen with mesal processes blunt-pointed, armed with conspicuous rounded denticles, which continue along ventral margins of tegumen to one-half; anal portion strongly chitinized, appearing as a rounded prominence. Harpe long and curved, outer margin somewhat irregular, sacculus absent; a well-chitinized saccular lobe at one-half. Juxta as wide as long, lateral margins concave. Eighth sternite longer than wide, the posterior extremity narrowed and strongly chitinized as a blunt process.

The genitalia figure was drawn from an example taken in the National Park, Queensland, in January, 1928. Dissections show that the posterior margin of the vinculum in this species is evenly convex and that the eighth sternite is produced into a blunt posterior process. This latter feature was interpreted as a "prominent median process" of the vinculum by Eyer and Turner (*loc cit.*, p. 272).

The species was taken by Scott at Ash Island many years ago, but the specimens remained undescribed. Dr. G. A. Waterhouse, who captured it in his garden at Killara on February 12, 1928, writes: "I was out at the back of my house just at dusk, and saw numbers of the *Oncopera* flying at one spot. I caught

one and . . . saw that it was not the common Hepialid. For the next week I was not at home or it was raining very hard. . . . After I had set the others [on February 22 and 26] I caught two which I think are the females of the same species." In 1929 he wrote: "Last year on the day I collected the eight specimens . . . they were exceedingly common, and I caught them all within a few minutes. . . . This year they are almost absent. On 17th February, with Goldfinch, we got two only, and may have seen another two. On the 19th February, though I waited from just before dusk until dark, I saw none. On the 22nd I caught the only two examples seen. On the 24th I caught one and may have seen another. They are not on the wing until 6.30 p.m., and it becomes too dark to see them after 7 p.m."

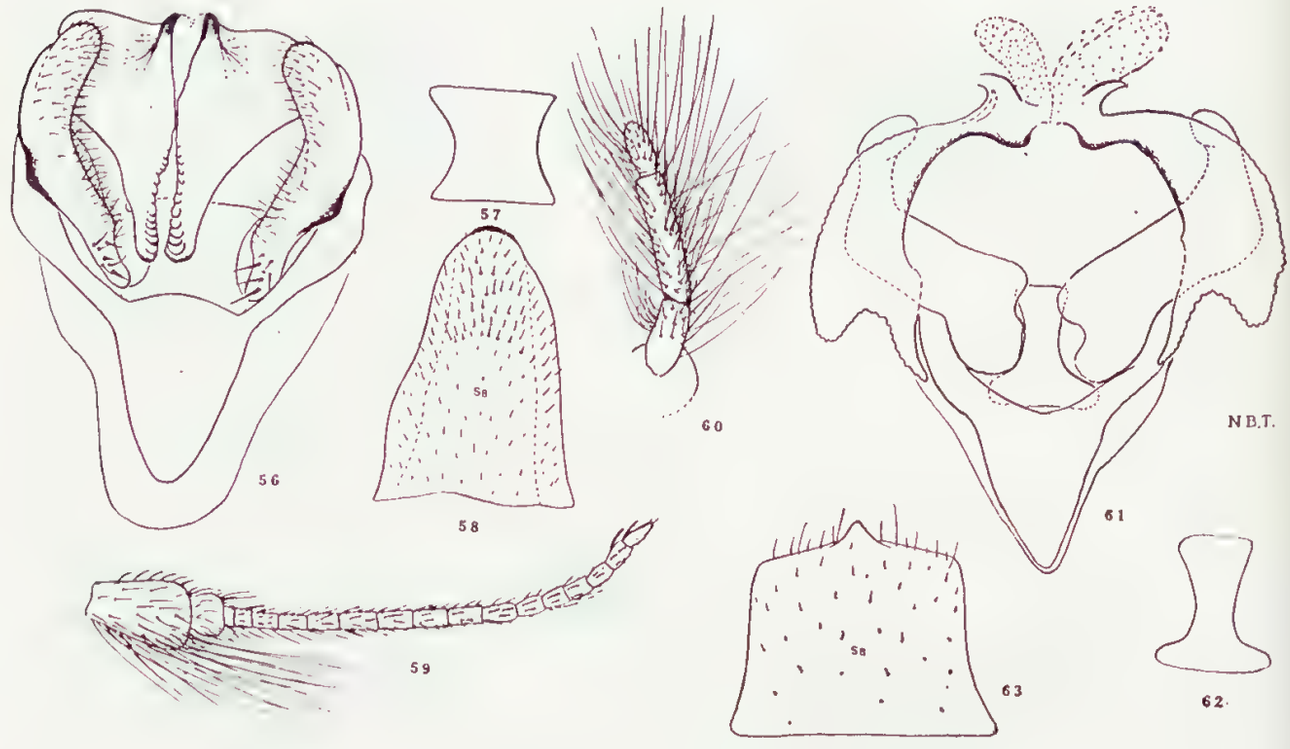

Fig. 56–63. 56–60. *Oncopera alboguttata* sp. nov. 56. male genitalia, National Park, Queensland; 57. juxta; 58. eighth sternite; 59. antenna; 60. labial palp. 61–63. *Oncopera brunneata* sp. nov. 61. male genitalia, Mt. Tomah 62. juxta; 63. eighth sternite.

Turner apparently sent Queensland National Park specimens of this species to Eyer under the name *O. mitocera*. Examination of the type of the latter has since shown that the present species is a distinct one, and that true *O. mitocera* has a well-defined sacculus somewhat similar to that of *O. epargyra*.

In the form of the wings this species is related to *O. epargyra*. The white base to the hindwings links it with *O. brachyphylla*, from which it differs markedly in wing-form and in the absence of sacculus in the male. By the latter character it is allied to the southern *O. intricata* group of species, but differs from

all of them in the form of the genitalia, wings, and antennae. The life-history is quite unknown.

ONCOPERA (PARONCOPERA) BRUNNEATA sp. nov.

Fig. 61-65.

♂ Antennae short, not clubbed, relatively smooth, a marked tuft of hairs at base. Head and thorax greyish-brown; legs greyish-brown, posterior pair ornamented with tufts of long bright ochreous hair. Forewings short, broad, R_4 and R_5 branching well before radio-median cross-vein, brown with numerous black scales, an oblique ochreous-brown fascia from near apex to two-thirds inner margin, obscure pale brown markings along costa, termen with obscure ochreous

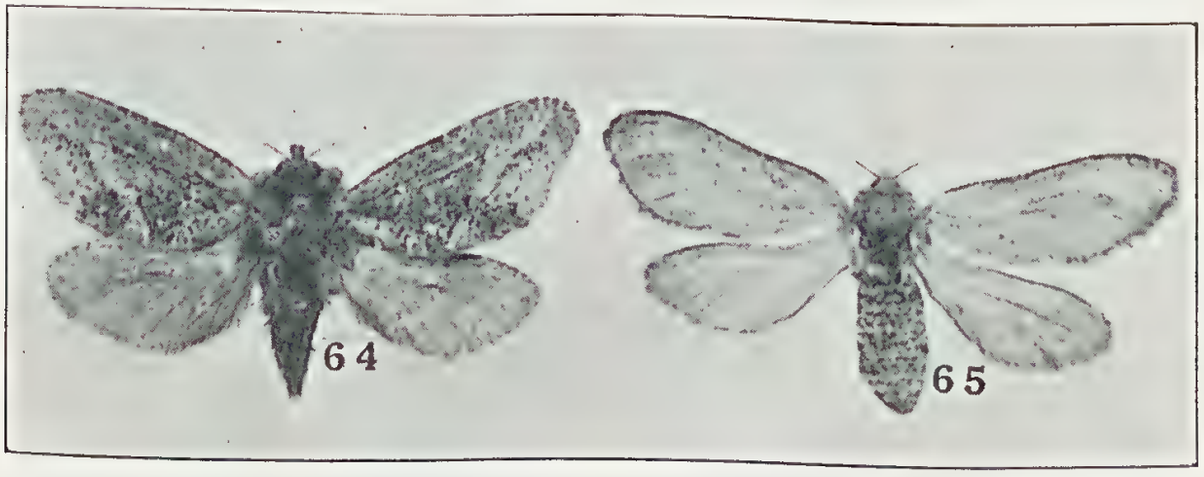

Fig. 64–65. *Oncopera brunneata* sp. nov. 64. paratype male, Mt. Tomah; 65. allotype female, Ebor.

suffusion, traces of ochreous blotches near base of wing, beneath uniformly grey. Hindwings rather uniformly grey, costa near apex rather narrowly barred with paler grey; beneath with apical third grey, posterior part of wing clothed with specialized silvery-white scales. Expanse, approx. 33 mm.

♀ Antennae as in male. Head, thorax, and legs pale greyish-brown. Forewings rather long and narrow, grey with a few obscure darker scales, no definite traces of pattern. Hindwings uniformly grey; beneath grey; no traces of silvery scales of male. Expanse, 35 mm.

Loc. New South Wales: Mount Wilson 1 (type, a male, January 11, 1929, A. J. Nicholson, I. 18675, in S. Aust. Mus.); Mount Tomah 12; Ebor 12 (December 27, 1911, R. J. Tillyard, allotype female, in Lyell coll.). 2 males, 1 female.

The dates of capture range from December 27 to January 11. The female from Ebor is worn, and as it was not taken with the male is associated with some

slight hesitation. In its diminutive size and in the form of the antennae it agrees quite well with the other examples.

The male genitalia have the vinculum wider than long, markedly V-shaped, with the posterior margin somewhat concave. The tegumen has the ventral margin (shown in lateral view in the figure) undulate and produced into a large rounded lobe. The harpe is long, dilated, especially near base, sharply angled at one-half, and inflated at apex. The juxta is in the form of an inverted T, and is longer than wide. The eighth sternite is as long as wide, and is armed with a conspicuous median process.

The possession of a process on the eighth sternite links this species with *O. mitocera*, from which it is otherwise distinct. The presence of specialized dense silvery-white scales on the posterior half of the underside of the hindwings allies it with *O. argentata* and *O. parva*, from both of which it is distinct in the presence of an oblique fascia from near apex to two-thirds inner margin.

Mr. G. M. Goldfinch has taken an example of this species, and has forwarded the following notes: "Mounts Wilson and Tomah . . . are only a few miles apart, and both are capped with basalt. The country is a rain forest area. The males fly at a great rate two or three inches above the ground in the scrub clearings, at late dusk, and are most difficult to see and catch. One is aware that something dark is flying. . . . I noticed that the specimen I finally caught had a definite track past the base of a small tree, and after several unsuccessful attempts secured it."

ONCOPERA (PARONCOPERA) BRACHYPHYLLA Turner.

Fig. 66-72.

Oncopera brachyphylla Turner, Proc. Linn. Soc. N.S. Wales, 1, 1925, p. 273, pl. xxxii, fig. 3.

♂ Antennae not clubbed, dark brown, smooth, a conspicuous tuft of hairs from base, apex acute. Head, thorax, and legs brown, posterior pair paler, with moderately developed ochreous tibial hair-tuft; abdomen greyish-brown. Forewings short, broad, with R_4 and R_5 branching just before radio-median crossvein, brown with some scattered black scales; an irregular white discal mark at two-thirds, connected by an oblique white fascia with three-fourths inner margin; traces of a subterminal grey line at one-half, internal to which there is an irregular black blotch; beneath uniformly dull brown, costa narrowly tinged ochreous. Hindwings, except at base, uniformly brown above and below, base obscured dull white. Expanse, 35 mm.

♀ Unknown.

Loc. Herberton 1, 2; Evelyn Scrub 2; Kuranda; Cairns district. 12 males.

The described male example (fig. 67) is one from Evelyn Scrub, February, 1911. A second example (fig. 66) has the forewings uniformly ochreous-brown with the white markings obsolete. In a third the white markings are also obsolete, but the apical half of the wing is obscurely and irregularly blotched with paler ochreous scales (fig. 68). In a fourth the ground-colour is paler ochreous-brown, with a broad irregularly-defined silvery-white streak from base to near one-half inner margin and a narrow discal streak from near base to three-fourths, where it is expanded to form an irregular blotched mark (fig. 69). An example of the type series from Evelyn Scrub has also been examined. The genitalia have been detached from this specimen, so that it is probably the one studied by Eyer.

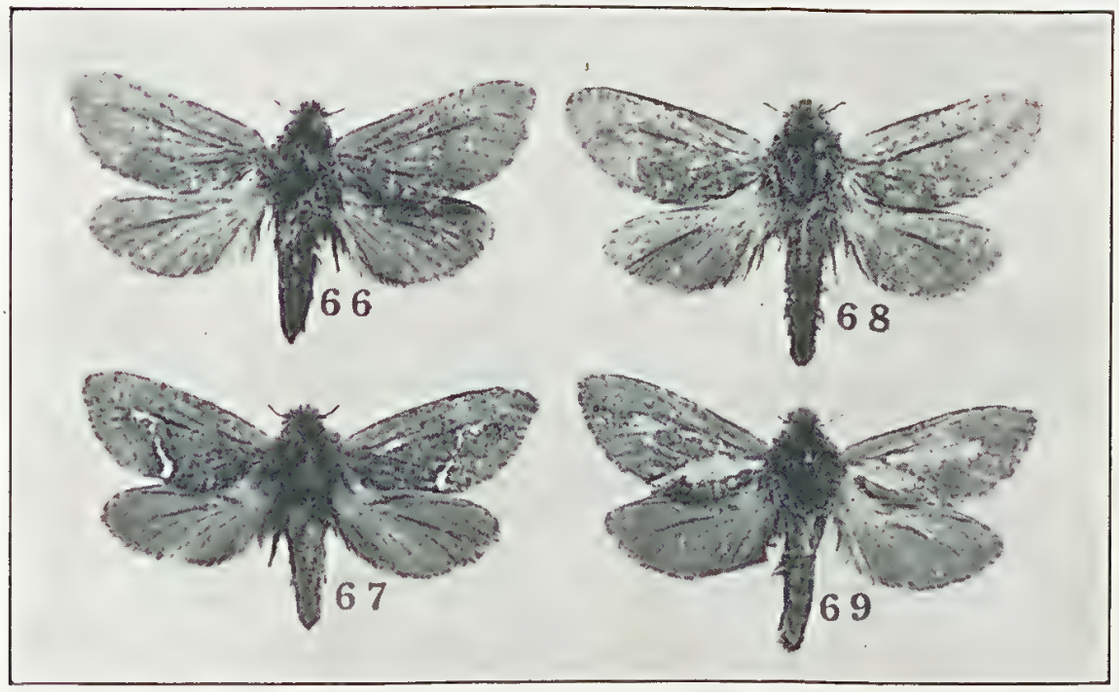

Fig. 66–69. *Oncopera brachyphylla* (Turner). 66. male, Herberton; 67. male, Evelyn Scrub; 68. male, Herberton; 69. male, Kuranda.

The male genitalia have the vinculum long and narrow, with the thinner lateral parts poorly developed; the posterior margin is slightly convex. The tegumen has long, unarmed mesal processes. The harpe is long and slender, has a narrow base, a short blunt sacculus, and a long curved cucullus. The juxta is wider than long, the anterior margin transverse, the other margins concave. The eighth sternite is about as wide as long, with the posterior margin strongly concave.

The short, broad wings and compact form of this species is characteristic; in this respect it shows some relationship to large examples of *O. parva* and to *O.*

argentata. It also resembles these two species in the unarmed margin of the tegumen with its long mesal process, but differs from them in possessing a reduced sacculus. From both of them it may also be distinguished by the uniformly brown hindwings and the absence of the specialized white scales beneath.

The late Mr. A. M. Lea found this species flying in the twilight of the rain forest before dusk. The type specimens were taken by Mr. F. P. Dodd in the Evelyn Scrub. It seems possible that the larvae recorded by Atherton as feeding on fallen leaves (see reference under *O. mitocera*) may belong to this species. He says:

"Larvae in the rain forest live in burrows with unprotected entrances. Here they feed on fallen leaves, in particular those of the strangling fig (probably *Ficus Watkinsonii*). These fallen leaves, though yellow to some extent, are usually succulent for some time after they fall to the ground; but dry leaves and even soft wood may be taken by the insect."

ONCOPERA (PARONCOPERA) PARVA sp. nov.

Fig. 73-76, 79-81.

♂ Antennae short, slender, smooth, not clubbed, a tuft of short hairs from base. Head and thorax pale brown, legs paler, posterior pair with long, well-developed tibial hair-tufts. Forewings slightly pointed at apex, R_4 and R_5 branching at radio-median cross-vein, pale brown with ochreous and creamy-white scales forming an obscure suffusion along costal margin and on apical third of wing. Hindwings greyish-brown, costa and apex rather broadly creamy-white; beneath with apical third dull brown, posterior two-thirds and base clothed with dull white scales. Expanse, 30 mm.

♀ Antennae short, dark brown; head, thorax, and abdomen dull fulvous. Forewings relatively long and narrow, dull greyish-brown with some paler scales, pattern obsolete. Hindwings pale brown, costa narrowly cream, beneath uniformly pale brown. Expanse, 34 mm.

Loc. Queensland: Cairns district (A. M. Lea, type, a male, and allotype female, I. 18676, in S. Aust. Mus.). 3 males, 1 female.

Two males and a female were taken together by the late Mr. A. M. Lea. The female example is rather worn. A third male (fig. 81), from the Lower collection, is larger (35 mm.), and differs from the typical form in possessing a broad creamy-white mark parallel to hind margin and extending to one-half, also a narrower discal streak from near base to three-fourths, and a rounded yellow spot at two-thirds inner margin. The posterior wings are similar to the typical form.

The male genitalia have the vinculum somewhat broad and the posterior

margin convex. The tegumen has the mesal processes relatively long, slender, and unarmed; in lateral view they are only slightly angled at their juncture with main body of tegumen. The harpe is long and narrow at the base, the sacculus is long and acute, the cucullus strongly angled at two-thirds. The juxta is subrectangular and longer than wide.

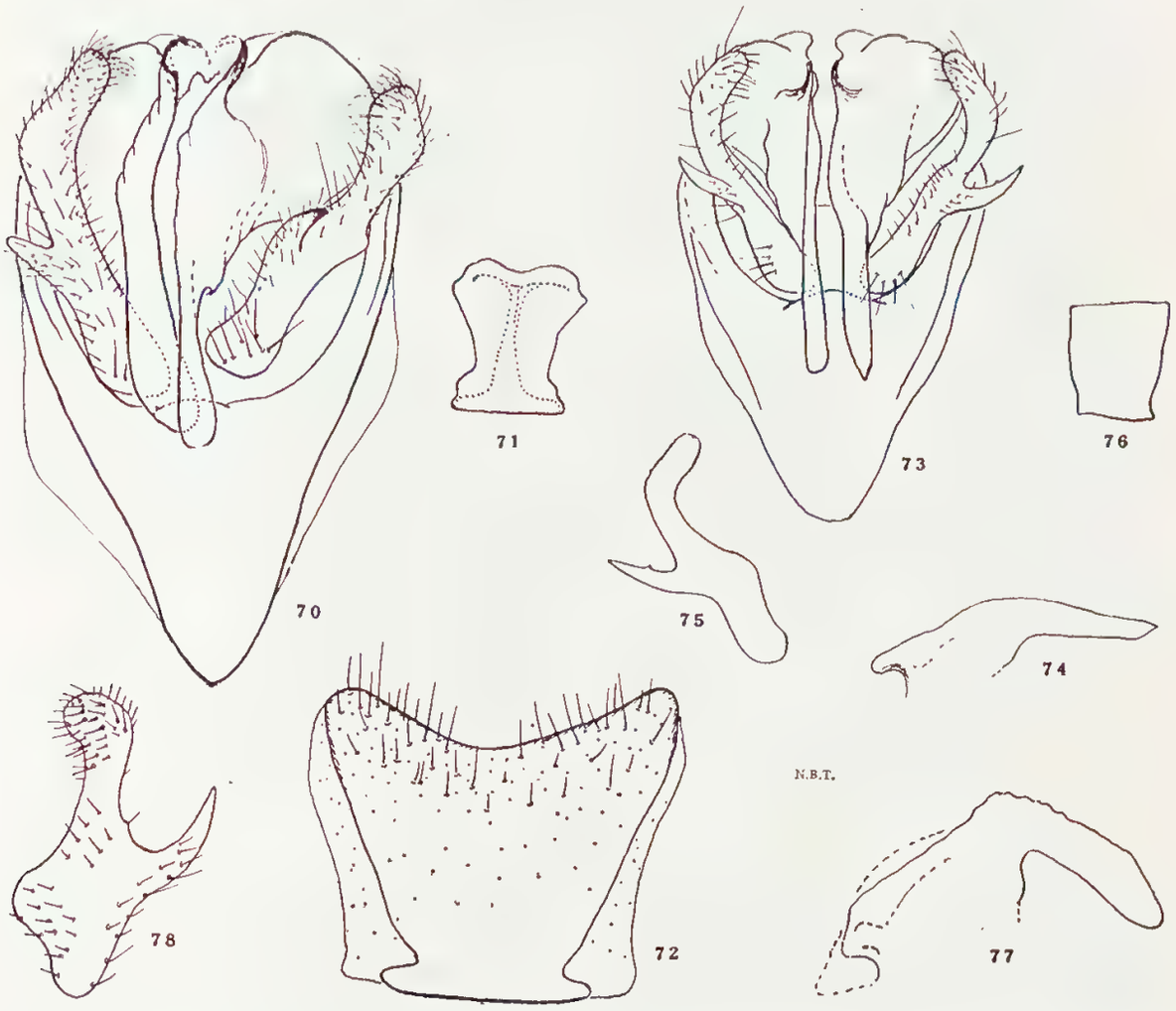

Fig. 70–78. 70–72 *Oncopera brachyphylla* (Turner). 70. male genitalia; 71. juxta; 72. eighth sternite. 73–76 *O. parva* sp. nov. 73. male genitalia; 74. lateral aspect of portion of tegumen; 75. harpe; 76. juxta. 77–78. *O. argentata* sp. nov. 77. lateral aspect of portion of tegumen; 78. harpe.

This species resembles *O. brunneata* in the underside of the hindwings and in the form of the wings of the female, but differs widely in the form of the male genitalia and in wing markings. From *O. brachyphylla* it is distinct in the long, slender mesal processes of tegumen, the long sacculus, rectangular juxta, and in the presence of specialized dull white scales on the underside of the hindwings. From the next species (*O. argentata*) it differs in the proportions of the harpe and in the absence of silvery-white scales on the base of the hindwings.

The exact localities of the types of this and the following species were not indicated by the late Mr. A. M. Lea, all the insect material he collected during his visit to North Queensland in the year 1912 being labelled simply "Cairns District." This obscures the relationship between the warm temperate fauna of the highlands and the coastal tropical species which he then collected.

The following principal collecting dates and locations may serve ultimately as clues to the real distribution of some of the species:

Cairns: February 12-13, 19-20; March 16-17, including attempts to visit Green Island; March 29. Very little collecting was done.
Kuranda: February 14; March 11-13; small collections only.
Nelson: February 15-19; March 14-15, 18-20, 28. Large collections.
Atherton: February 21-26. Abundance of insects of all kinds.
Tolga: February 26. Brief visit.
Malanda: February 26 to March 1. Good collecting.
Yungaburra: March 2. Brief visit.
Chumbrumbra: March 3. Brief visit.
Peeramon: March 4-5. Brief visit.
Kulara: March 6-7, 9-10. Extensive collections.
Sharp's Siding (Yungaburra): March 7-8. Good collections.
Harvey Creek, at base of Belenden Ker: March 20-27. Large collections.
Edge Hill, near Cairns: March 30. A brief visit only.

ONCOPERA (PARONCOPERA) ARGENTATA sp. nov.

Fig. 77-78, 82.

♂ Head and thorax ochreous-brown. Forewings with R_4 and R_5 branching just before radio-median cross-vein, dull brown, costa near base pale ochreous with traces of brown spots near apex, whole of discal region from base to three-fourths clothed with specialized cream-tinged silvery-white scales; beneath uniformly dull brown. Hindwings dull brown, apex broadly, termen and veins narrowly pale ochreous, discoidal region narrowly and base broadly clothed with silvery-white scales; beneath with costal third dull brown, posterior portion dull white. Expanse, 36 mm.

Loc. Queensland: Cairns district (A. M. Lea, type, I. 18677, in S. Aust. Mus.). 1 male.

The male genitalia are somewhat similar to those of *O. parva;* the harpe has the base very broad, the sacculus almost as long as cucullus; the cucullus short, bent, and inflated at apex. The mesal processes of tegumen are unarmed; in lateral view they are strongly angled at juncture with main body of tegumen.

In the form of the male genitalia this species appears to be most nearly related to *O. epargyra,* but it differs from the published figure and description in possessing an apically dilated cucullus. The form of the median process of the tegumen also appears to be different.

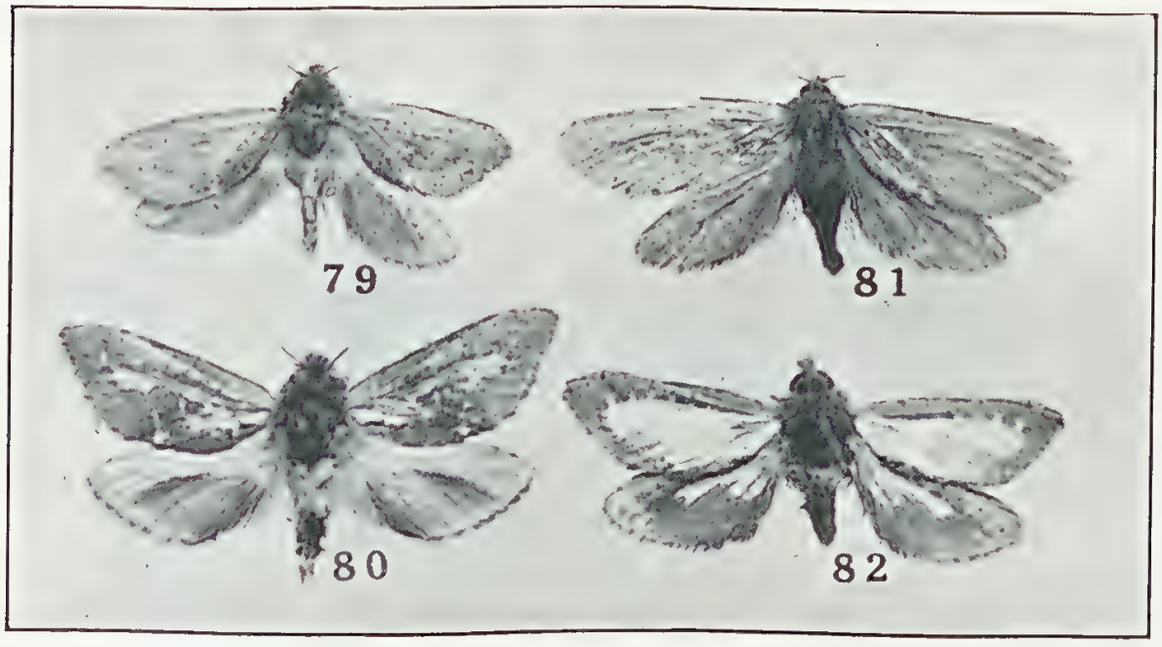

Fig. 79–82. 79–81. *Oncopera parva* sp. nov. 79. type, a male, Cairns district; 80. allotype female, Cairns district; 81. male, Cairns district. 82. *O. argentata* sp. nov. type, a male, unique, Cairns district.

At first sight it is very close to *O. parva,* but the different harpe, stout, bent mesal process of tegumen, and the silvery-white scales on hindwings are distinctive.

ONCOPERA (PARONCOPERA) EPARGYRA Turner.

Oncopera epargyra Turner, Proc. Linn. Soc. N.S. Wales, l, 1925, p. 273, pl. xxxii, fig. 4.

"Valves with sacculus narrow and acutely pointed, almost as long as cucullus, cucullus less broad than in *brachyphylla,* not dilated apically; eighth sternite shuttlecock-shaped, upper angles projecting; vinculum broad, not emarginate, without median process; aedeagus a somewhat oval plate."

Loc. Queensland: National Park, 3,000 feet) 12.

This species was described from two examples taken in the National Park, Queensland. The type has not been examined, but Dr. Turner has kindly forwarded the second specimen for study. This unfortunately proves to belong to a different species (*O. alboguttata*), in which there is no sacculus. Eyer and Tur-

ner's figure and the description of the genitalia in their key (*loc. cit.*, p. 272) should be sufficient to determine the species when further material is available.

ONCOPERA (PARONCOPERA) MITOCERA (Turner).

Fig. 83-92.

Oncoptera mitocera Turner, Ann. Queensl. Mus., 1911, p. 132.
Oncopera mitocera Aurivillius, Arkiv. f. Zool., Stockholm, 13 (2), 1920, p. 43.
Oncopera mitocera ab. *suffusa* Aurivillius, *loc. cit.*
Oncopera mitocera ab. *lineata* Aurivillius, *loc. cit.*
Oncopera mitocera ab. *vittata* Aurivillius, *loc. cit.*
Oncopera mitocera Philpott, Trans. New Zeal. Inst., 57, 1926, p. 725, fig. 15 (maxilla).
Oncopera epargyra Philpott, Trans. Ent. Soc. Lond., 75, 1927, pl. 1, fig. 9 (genitalia).
Oncopera mitocera Atherton, Grass pests of the Atherton tableland, pamphlet, 8 pp., Dept. Agriculture, Queensland, Nov., 1931, p. 5 (bionomics).

♂ Antennae short, slender, not clubbed, clothed with flat scale-like hairs, a tuft of long hairs at base, usually twenty segments. Head, thorax, and legs ochreous-brown, abdomen darker. Forewings with R_4 and R_5 branching at radio-median cross-vein; brown with obsolete traces of a subterminal oblique fascia from disc to two-thirds inner margin. Hindwings grey, apex paler, costa narrowly ochreous, beneath grey near apex, base and portion of posterior half of wing with dull white specialized scales. Expanse, 44 mm.

♀ Head, thorax, and legs dull ochreous brown. Forewings pale ochreous with darker brown scales forming an obscure pattern. Hindwings dull greyish-brown, at apex irregularly paler, giving a dappled effect; wings below uniformly dull brown. Expanse, 53 mm.

Loc. Queensland: Kuranda 4 (type, a male, April, 1907, in Turner coll.); Herberton 2; Cairns. 25 males, 11 females.

Dr. Turner's type example has been described and figured. The second male specimen differs in possessing a dull white subterminal fascia somewhat expanded in discoidal region, and an equally well-defined white streak nearly parallel to the inner margin and extending from the base to the subterminal fascia. The female described was taken by Mr. F. P. Dodd at the same place as the type, in April, 1910. The second female is an example from Cairns in the MacLeay Museum. It is of a somewhat duller brown than the first one, and may possibly not belong to the species; it differs in that R_4 and R_5 branches well after the radio-median cross-vein.

The male genitalia have the vinculum strongly V-shaped; the thinly chitinized marginal parts are broad; the posterior margin slightly concave. Tegumen with ventral margins inflated, strongly armed with denticles from mesal process nearly to anal extremity. Harpe stout at base, with long, acutely-pointed sacculus present; cucullus slender, curved, slightly inflated at apex. Juxta about as wide as long, anterior margin slightly concave, posterior notched, lateral margins deeply concave. Eighth sternite armed with a stout median process.

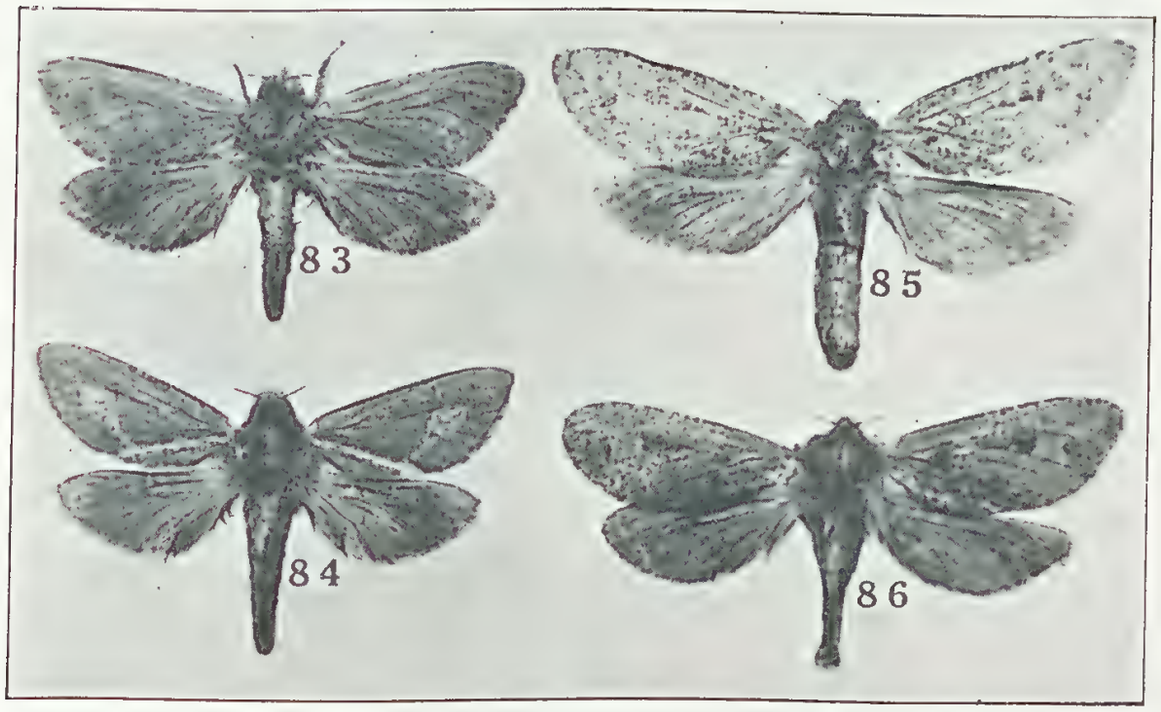

Fig. 83–86. *Oncopera mitocera* (Turner). 83. type, a male, Kuranda; 84. male, Kuranda; 85. female, Kuranda; 86. female, Cairns.

Three forms or aberrations of the male of this species have been described by Aurivillius but have not yet been recognized amongst our material:

f. *suffusa* Aurivillius. "Alae anticae supra ochraceae fasciis tribus irregularibus fusco-brunneis, ad marginem posticum conjunctis costam autem haud altingentibus ornatae; fasciae duae primae latae, tertia submarginalis angustior et prope medium excurvata, omnes guttis parvis niveis irregulariter conspersae."

f. *lineata* Aurivillius. "Alae anticae supra subaequaliter fusco-brunneo-et ochraceo-variegatae, inter marginem posticum et costam 7 linea postdiscali undulata nivea fusco marginata ornatae."

f. *vittata* Aurivillius. "Alae anticae supra brunneo-ochraceae vitta mediana fere a basi ad apicem cellulae et deinde in plagam magnam apicem et angulum posticum versus dilatata ornatae."

These three male forms were taken at Malanda, Queensland, in association with normal examples. In the absence of figures it is not possible to state whether they are colour forms of *O. mitocera* or separate species.

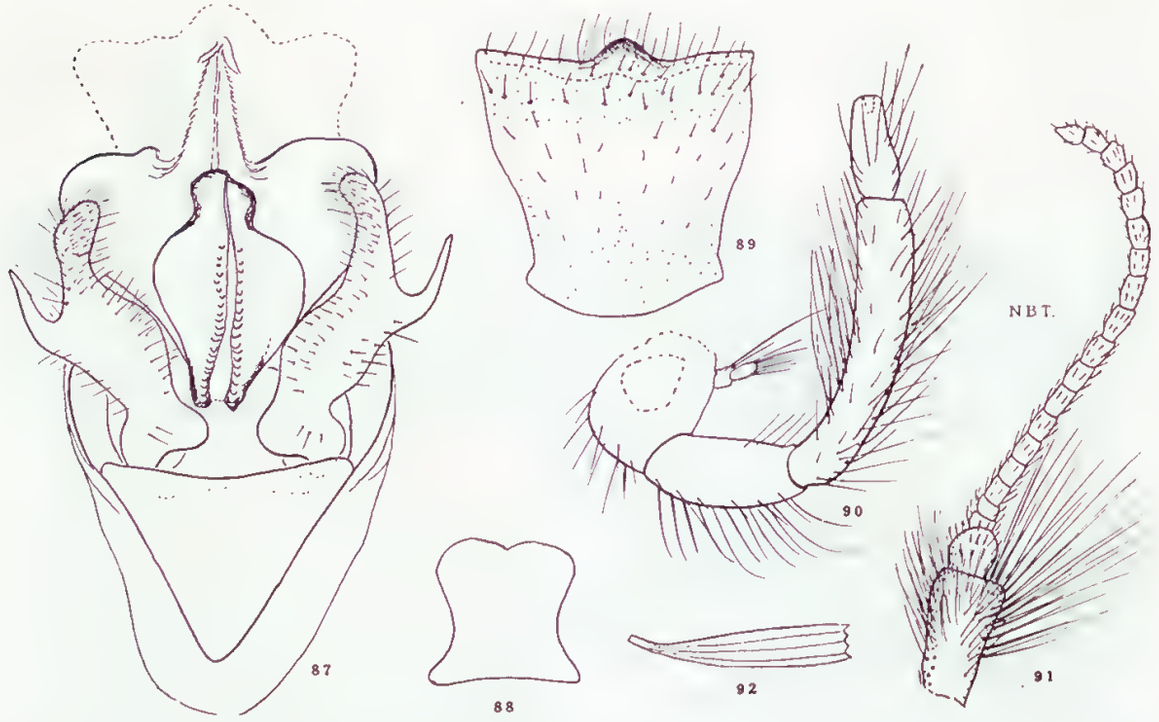

Fig. 87–92. *Oncopera mitocera* (Turner). 87. male genitalia; 88. juxta; 89. eighth sternite; 90. labial palp, showing rudimentary maxillary palp; 91. antenna; 92. an antennal scale.

This species is of considerable economic importance, owing to its depredations, in the larval state, upon the pasture lands of the Atherton Tableland in North Queensland. Some details of the life-history are known. According to Atherton, who has made some interesting observations, *Oncopera* moths are on the wing between January and April. Eggs are distributed freely among the grass, and larvae may be collected from July to December; when full grown they attain a length of over 5 cm. "Pupation takes place in the larval burrow from December to March at a depth of 4 to 6 inches. . . . The . . . vertical burrows excavated by the grubs may be from less than 6 inches to more than 15 inches in depth, the last 3 or 4 inches being unlined with silk. The larvae may construct a chamber in the burrow just below the surface of the ground, which possibly facilitates turning when excavations are in progress. The soil is apparently collected from the base of the extending burrow and held in the mouth parts as the larva backs into the chamber, in which it turns before carrying the burden outside. . . . It is commonly found that in pastures with a fairly long growth . . . the larva builds

a sort of anteroom over its burrow . . . brought to within ½ inch of the surface, and there flared out like the top of a test tube. Built over the top of this is a covering consisting of pieces of earth and dead grass. . . . The whole of the cavity is lined with silk, and a passage-way of similar material leads away from it in a horizontal direction."

On general grounds it is tempting to disagree with Atherton's conclusions (not quoted here), which suggest that *O. mitocera* was originally a rain-forest dweller, with a dead-leaf-eating larva, and that its attacks on pasture grasses are an induced habit brought about by the clearing of the jungle and the destruction of its normal food. It seems possible that the observed differences of habit between the grass-feeding larvae which build an ante-room to their silk-lined burrow, and the rain-forest-dwelling, dead-leaf-eating larvae with an unprotected entrance to the burrows, are of a specific nature.

REMARKS ON THE NEW HARPID (MOLLUSCA) GENERA OF FINLAY AND IREDALE

By BERNARD C. COTTON and NELLY HOOPER WOODS, M.A.

Fig. 1-9.

The two papers referred to in this article are:

Finlay: Trans. N. Zeal. Inst., lxii, May 23, 1931, pp. 11-14.

Iredale: Rec. Aust. Mus., xviii, No. 4, June 29, 1931, pp. 230-231.

In these works, published within a month of each other, two leading Australasian conchologists express their views on the generic location of some dozen species of the family *Harpidae*.

As we have the type specimens of ten of these comparatively rare forms, we take this opportunity of making clear some of the complications which have ensued. Finlay proposes to use three genera, Iredale four, the latter all new and three without a description. Finlay introduces *Austroharpa*, taking as type a species (*Harpa pulligera* Tate) with an extreme form of large and bulbous protoconch. The remaining members of the genus have a protoconch of the same type, but smaller and more depressed. For the same group Iredale introduces *Deniharpa* without a description, and this name becomes a synonym. Similarly *Refluharpa* was introduced without diagnosis; he merely states: "*H. lamellifera* and *H. sulcosa* may be classed together under the generic name *Refluharpa*. . . ." As far as the protoconch is concerned *Harpa lamellifera* Tate is a typical *Eocithara* and *Harpa sulcosa* Tate is an *Austroharpa*. Therefore *Refluharpa* is a synonym of *Eocithara*. For *Harpa spirata* Tate, Iredale introduces *Trameharpa*, merely stating, "*H. spirata* is separable with the generic name *Trameharpa*." But we agree with Finlay that *Harpa spirata* Tate is an *Austroharpa*, so that *Trameharpa* becomes a synonym.

Austroharpa tatei Finlay, from an examination of Abattoir Bore specimens, seems to be a local variety of *A. sulcosa* Tate, the type of which is the most deeply sulcate of our specimens. Iredale states: "*Harpa pachycheila* can be compared with *abbreviata*," in what respect he does not say. *Harpa abbreviata* has the *Austroharpa* type of protoconch, and so has *Harpa pachycheila* Tate, though in the latter species it is much smaller. We do not think *H. pachycheila* Tate and *H. cassinoides* Tate are cassids, as Finlay suggests. They have not the

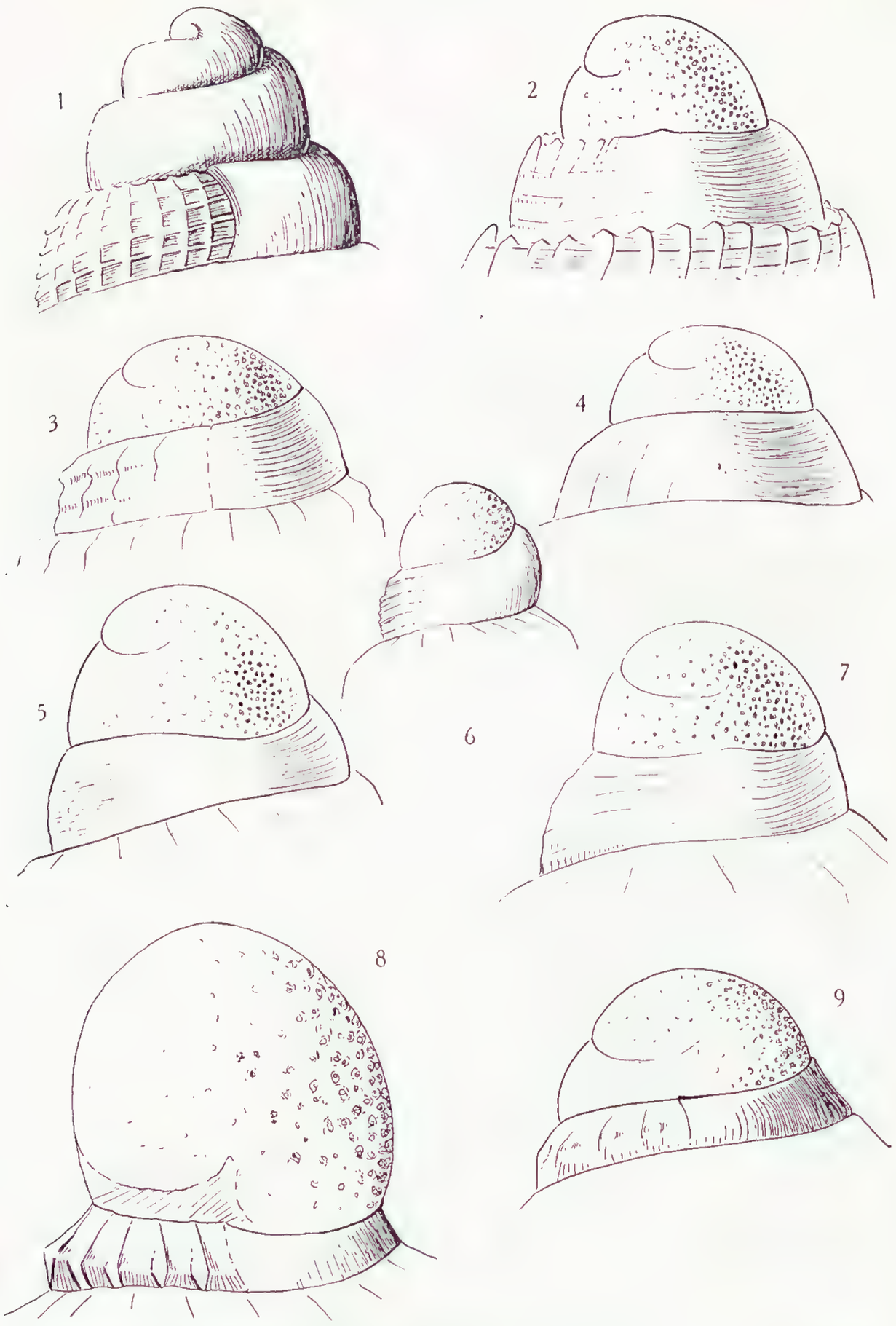

Fig. 1–9. Protoconchs of Mollusca of the family Harpidae (all × 10). 1. *Eocithara lamellifera;* 2. *Austroharpa sulcosa;* 3. *A. spirata;* 4. *A. cassinoides;* 5. *A. clathrata;* 6. *A. pachycheila;* 7. *A. abbreviata;* 8. *A. pulligera;* 9. *A. tenuis.*

widely reflected inner lip, the dentition of the outer lip, the plication on the columella and the sharply recurved snout of *Cassis*.

On protoconch features they should be placed in *Austroharpa*, and also the recent *H. punctata* Verco. Iredale's new species, *P. exquisita*, the type of the new genus *Palamharpa*, appears to be an *Austroharpa*, so that *Palamharpa* probably becomes another synonym of *Austroharpa*.

Our classification then reads:

Austroharpa Finlay, May, 1931, type *H. pulligera* Tate = *Deniharpa*, *Trameharpa*, and *Palamharpa* Iredale, June, 1931.

A. pulligera (Tate), *spirata* (Tate), *sulcosa* (Tate), *tatei* Finlay (? = *sulcosa* var.), *tenuis* (Tate), *clathrata* (Tate), *punctata* (Verco), *pachycheila* (Tate), *cassinoides* (Tate), *exquisita* (Iredale), *abbreviata* (Tate).

Eocithara Fischer, 1883, type *H. mutica* Lamarck = *Refluharpa* Iredale, June, 1931, *E. lamellifera* (Tate).

NOTES ON THE TYPE SPECIMENS OF HESPERIIDAE (LEPIDOPTERA) IN THE MUSEUMS IN AUSTRALIA, WITH SPECIAL REFERENCE TO THOSE IN THE SOUTH AUSTRALIAN MUSEUM

By G. A. WATERHOUSE, D.Sc., B.E., F.E.S.

On a recent visit to Adelaide (April, 1932), Brigadier W. H. Evans and the writer were granted facilities to study the Lower Collection of Hesperiidae, which had been purchased by the South Australian Museum. In this examination we were ably assisted by Mr. N. B. Tindale, of the Museum. As a number of doubtful points arose, it seemed desirable that they should be recorded before General Evans leaves Australia, so that he might concur in them; Mr. Tindale has also seen this paper before publication.

As the South Australian Museum authorities have purchased the collection of the late Dr. T. P. Lucas, of Brisbane, which contains several types of Rosenstock and Miskin, and have had in their possession for many years types of species described by Tepper and Guest, these also are included.

To make this review more comprehensive, some of the types of this family in the other Australian Museums are treated as well.

The late Mr. O. B. Lower was the first Australian entomologist to study in detail this interesting family, and all his papers on it have been published in the *Transactions of the Royal Society of South Australia.* The first paper appeared in 1902, xxvi, by Meyrick and Lower (quoted M. and L., 1902), and as stated on page 39, Meyrick drew up the generic characters and identified the species, whilst Lower was responsible for the descriptions.

Lower in the same *Transactions* for 1907 and 1908 (quoted Low., 1907, and Low., 1908) described further species, and in 1911 (quoted Low., 1911) published his final revision. During the time Lower was preparing this last revision I was in constant correspondence with him, and lent him numbers of specimens; I have still the correspondence in my possession, and it has been very useful in elucidating several doubtful points. This correspondence will be deposited in the Australian Museum, Sydney, for future reference.

Lower, early in 1908, wrote saying he would give the type localities, but in most cases he failed to do so, and I have, aided by my two friends, endeavoured to rectify this. All specimens marked as types by Lower have been carefully checked with his descriptions, and where no specimen was marked as type one

has been nominated as such, care being taken to see that it was one of the original series and that it agreed with the description.

In 1914 *The Butterflies of Australia*, by Waterhouse and Lyell, was published (quoted W. and L., 1914), when several changes were made in the classification, some new species described, and all the then known species figured. Almost all the specimens used to illustrate this work are now in the Australian Museum, Sydney.

The above works will be those that are chiefly quoted, and the species will be listed under the names given in Lower's revision of 1911.

TRAPEZITES HETEROMACULA Meyrick and Lower.

Trapezites heteromacula M. and L., 1902, p. 84; W. and L., 1914, p. 176, fig. 622, 623.

The holotype is a male from Cooktown (Endeavour River) in the Macleay Museum, University of Sydney. Lower's locality, Cairns (Low., 1911, p. 136), requires confirmation, as I have never seen a specimen from there.

TRAPEZITES LUTEUS (Tepper).

Hesperilla lutea Tepper, Trans. Roy. Soc. S. Aust., iv, 1881, p. 33, pl. ii, fig. 6.
Trapezites lutea Low., 1911, p. 137 (in part).
Trapezites luteus W. and L., 1914, p. 177, fig. 660, 748.

Tepper's holotype male is from Ardrossan, South Australia, and is now in very poor condition. This species must be very rare in South Australia, as Lower only had one male from Port Lincoln and one male from Stonyfell, and I have another male from the latter locality, given me by Lower. Two specimens only are known from Victoria, both caught at Castlemaine in February. Other specimens are known from New South Wales and South Queensland. Lower's record of Duaringa in 1902 (M. and L., p. 91), but omitted in 1911 (Low., p. 137) is no doubt correct, as there was an undoubted specimen with a Duaringa label in his collection amongst his specimens of *T. petalia*. The Hobart locality refers to the race *glaucus* W. and L., *l.c.*, 1914, p. 177, fig. 661, 739.

TRAPEZITES PHIGALIA (Hewitson).

Hesperia phigalia Hew., Desc. Hesp., 1868, p. 32.
Trapezites phillyra Miskin, Proc. Roy. Soc. Qld., vi, 1889, p. 153.

The holotype male *phillyra* Miskin, which is a synonym of *phigalia*, is in the South Australian Museum Collection from the Lucas Collection. In the Lower Collection are two males and one female labelled Cairns, Lower Coll., but this locality requires confirmation.

ANISYNTA POLYSEMA (Lower).

Hesperilla polysema Low., 1908, p. 311, female.
Anisynta polysema Low., 1911, p. 142, male; W. and L., 1914, p. 183, fig. 745, 754.

The holotype is a female from Petford, near Chillagoe, Queensland, February, 1908, and is now in the Australian Museum. The allotype male is in the South Australian Museum, from Port Darwin, February, 1909, and there is also a paratype male in the Australian Museum from Port Darwin, February, 1909. Other known specimens are from Port Darwin, males January and March, female April. A male from Flinders Island, Queensland, January, 1927, is in the South Australian Museum, and I have seen a male from Stanley Island, Queensland, January, 1927.

ANISYNTA SPHENOSEMA (Meyrick and Lower).

Trapezites sphenosema M. and L., 1902, p. 92.
Trapezites paraphaes M. and L., 1902, p. 93.
Anisynta sphenosema W. and L., 1914, p. 181, fig. 643-6.

Described from a single specimen said to be a female, but the specimen in the Lower Collection, marked as type female, on examination proved to be a male, No. 3775, from Perth, Western Australia, collected in November by F. M. Angel. No specimen marked as the type of *paraphaes* could be found, but this name was sunk under *sphenosema* by Lower in 1911, p. 143, and no separation under these two names was made in his collection.

ANISYNTA CYNONE (Hewitson).

Cyclopides cynone Hew., Exot. Butt., v, 1874, fig. 17.
Hesperilla gracilis Tepper, Trans. Roy. Soc. S. Aust., iv, 1881, p. 34, pl. ii, fig. 7.
Anisynta cynone W. and L., 1914, p. 182, fig. 761-3.

General Evans writes from London that he has examined Hewitson's type of *cynone* in the British Museum. It was the only specimen there, and is a male labelled "Australia." On comparing it with specimens from South Australia (*gracilis* Tepper) and Victoria (*grisea* Waterhouse, Proc. Linn. Soc. N.S. Wales, 1932, p. 220), which he had taken to London, he finds that the type is smaller (25 mm. against 28–30 mm.), with wings rather more pointed, on forewing no spots in 1a, 4, and 5, only the cell spot, discals in 2 and 3, and three subapical dots. The hindwing below is more greenish-ochreous, as in *grisea*, but the discal band is darkened, appearing as composed of darkish brown contiguous spots; the basal markings tend to be similar, i.e., dark and macular. It must be regarded as a separate race from some other, perhaps intermediate, locality, and if anything nearer *grisea*.

Hewitson described the underside of *cynone* as "rufous-brown with several white spots separated by a band of black spots." The figure is of the underside, and is not very satisfactory. The type locality of *cynone* for the present is unknown, and there will be two races, *gracilis* and *grisea*.

MESODINA AELUROPIS Meyrick.

Mesodina aeluropis Meyrick, Ent. Mo. Mag., xxxvii, 1901, p. 168; M. and L., 1902, p. 46; W. and L., 1914, p. 180, fig. 698-9.

The holotype male is in Meyrick's collection from Katoomba, New South Wales, in November. This species is confined to the Blue Mountains, from Wentworth Falls to Mount Victoria.

MESODINA HALYZIA CYANOPHRACTA Lower.

Mesodina halyzia cyanophracta Low., 1911, p. 119; W. and L., 1914, p. 180, fig. 774-5.

There were two males and two females in the Lower Collection, all from Perth, Western Australia, but without type labels. A male specimen was nominated as holotype, and a female, caught in November, 1900, as allotype.

HESPERILLA MUNIONGA Olliff.

Hesperilla munionga Olliff, Proc. Linn. Soc. N.S. Wales, iv, 1889, p. 623; Low., 1911, p. 136.

Oreisplanus munionga W. and L., 1914, p. 184, fig. 670.

Holotype male and allotype female in Australian Museum, from Mount Kosciusko, March, 1889.

HESPERILLA COMPACTA (Butler).

Telesto compacta Butler, Ann. Mag. Nat. Hist., (5) ix, 1882, p. 87.

Hesperilla compacta Low., 1911, p. 124.

Dispar compacta W. and L., 1914, p. 197, fig. 705-8.

Telesto scepticalis Rosenstock, Ann. Mag. Nat. Hist., (5) xvi, 1885, p. 379, pl. xi, fig. 2.

There is a female of *scepticalis* in the South Australian Museum from the Lucas Collection, from Healsville, Victoria, which was no doubt seen by Rosenstock, but the holotype so marked is in the British Museum.

HESPERILLA TYMBOPHORA (Meyrick and Lower).

Telesto tymbophora M. and L., 1902, p. 70.

Hesperilla tymbophora Low., 1911, p. 124.

Signeta tymbophora W. and L., 1914, p. 198, fig. 662-4.

Holotype male from Mount Kembla, New South Wales, in the South Australian Museum, with allotype female and other males labelled *tymbophora* by Lower in the Australian Museum from Mount Kembla.

HESPERILLA LEUCOSTIGMA (Meyrick and Lower).

Telesto leucostigma M. and L., 1902, p. 73.
Toxidia leucostigma leucostigma W. and L., 1914, p. 191, fig. 616-7.

The original description (1902, p. 73) includes the northern race (*parasema*) as well as the southern race. The holotype is a male labelled Sydney, but this should be Mount Kembla, New South Wales. No female of the southern race was found in the Lower Collection. In a letter to me, dated June 4, 1908, he stated he had no females. In the Australian Museum there are a male and a female from Mount Kembla labelled as *leucostigma* by Lower.

HESPERILLA LEUCOSTIGMA PARASEMA Lower.

Hesperilla leucostigma parasema Low., 1908, p. 312; Low., 1911, p. 125; W. and L., 1914, p. 192, fig. 637-8.

The holotype male is the specimen from Kuranda, October, mentioned in 1902, p. 73. It was caught by Dr. A. J. Turner in 1900. The allotype female is from Kuranda, Dodd, December, 1904. Both are in the South Australian Museum.

HESPERILLA MASTERSI Waterhouse.

Hesperilla mastersi Waterhouse, Proc. Linn. Soc. N. S. Wales, xxv, 1900, p. 54, pl. i, fig. 5-8; Low., 1911, p. 135; W. and L., 1914, p. 186, fig. 650-1.

Holotype male, Clifton, January, 1897, and allotype female from Mount Kembla, New South Wales, in Australian Museum. An additional locality is Narrara, near Gosford, in November and December (H. L. Moss-Robinson).

HESPERILLA ORNATA MONOTHERMA (Lower).

Hesperilla ornata monotherma Low., 1907, p. 169; Low., 1911, p. 135; W. and L., 1914, p. 185, fig. 635-6.

The holotype is a female from Kuranda, October, 1906 (F. P. Dodd). The male is much nearer the typical southern race on the upperside.

HESPERILLA CRYPSARGYRA CRYPSARGYRA (Meyrick).

Telesto crypsargyra Meyrick, Proc. Linn. Soc. N.S. Wales, ii, 1887, p. 829.
Hesperilla crypsargyra W. and L., 1914, p. 186, fig. 600-1.

The holotype is a male from Blackheath, New South Wales, in November or February.

HESPERILLA CRYPSARGYRA HOPSONI Waterhouse.

Hesperilla crypsargyra hopsoni Waterhouse, Proc. Linn. Soc. N.S. Wales, lii, 1927, p. 282, pl. xxvi, fig. 11-12, 15-16.

The holotype male (bred in Sydney in October) and the allotype female, February, are in the Australian Museum, from Barrington Tops, New South Wales. A new locality is Deervale, near Dorrigo, New South Wales.

HESPERILLA IDOTHEA (Miskin).

Trapezites idothea Miskin, Proc. Roy. Soc. Qld., vi, 1889, p. 152.
Hesperilla idothea Low., 1911, p. 123; W. and L., 1914, p. 187, fig. 716-8.
Trapezites dispar Kirby, Ann. Mag. Nat. Hist., (6) xii, 1893, p. 435.

The holotype is a female from Victoria, in the South Australian Museum, from the Lucas Collection. It should be noted that Kirby described both sexes, and not only the male, as Lower (1911, p. 123) has listed.

HESPERILLA CHAOSTOLA (Meyrick).

Telesto chaostola Meyrick, Proc. Linn. Soc. N.S. Wales, ii, 1887, p. 830; M. and L., 1902, p. 65.
Hesperilla chaostola Low., 1911, p. 132; W. and L., 1914, p. 187, fig. 690-1, 700.

The holotype is a male from Blackheath, New South Wales, in November, in Meyrick's Collection. The species is very rare in New South Wales, but is more common in Victoria, and a very few specimens are known from Tasmania. The allotype female is from Huonville, Tasmania, in December, and is in the Lyell Collection, and not in Lower's Collection, as stated (Low., 1911, p. 132).

HESPERILLA CRYPSIGRAMMA (Meyrick and Lower).

Telesto crypsigramma M. and L., 1902, p. 81.
Hesperilla crypsigramma Low., 1911, p. 128.
Toxidia crypsigramma W. and L., 1914, p. 190, fig. 639-40.

The holotype male in the Lower Collection, from Herberton, is one of two specimens caught by C. J. Wilde; the other is in the Queensland Museum, Brisbane. Lower also had a male from Bunya Mountains, Queensland (November, 1891, H. Tryon). There was also in the Lower Collection a female from Herberton, Queensland (January 31, 1911, F. P. Dodd), but it was placed under *sexguttata*, which was not represented in his collection.

HESPERILLA MALINDEVA Lower.

Hesperilla malindeva Low., 1911, p. 129.
Toxidia malindeva W. and L., 1914, p. 190, fig. 740-1, 749.

The holotype male is in the Lower Collection, the allotype female and a paratype male in the Australian Museum, all from Herberton, Queensland, in January, 1910, F. P. Dodd. Lower also had five males and three females from Herberton, January 31, 1911, no doubt added after his description was written.

The species has been caught and bred by Mr. J. Macqueen, near Milmerran, South Queensland, from October to January.

HESPERILLA SEXGUTTATA (Herrich-Schaeffer).

Telesto sexguttata Herrich-Schaeffer, Stett. Ent. Zeit., 1869, p. 80, pl. iii, fig. 16.
Hesperilla sexguttata Low., 1911, p. 126.
Toxidia sexguttata W. and L., 1914, p. 191, fig. 641-2.

The holotype is a female, as shown by the figure, but its whereabouts is unknown. The type locality is Rockhampton. It was not represented in Lower's Collection. Of his localities Rockhampton is from Herrich-Schaeffer. Bowen refers to a male and female in the Queensland Museum, and Herberton refers to the female *crypsigramma*, which he thought to be *sexguttata*. Of this rare species there is a pair in the South Australian Museum from Grote Island and a female from Winchelsea Island.

HESPERILLA TYRRHUS (Mabille).

Toxidia tyrrhus Mab., Comp. Rend. Soc. Ent. Belg., xxxv, 1891, p. lxxx.
Hesperilla tyrrhus Low., 1911, p. 126.
Toxidia tyrrhus W. and L., 1914, p. 192, fig. 618-9.
Telesto bathrophora M. and L., 1902, p. 82.

As stated by Lower (1911, p. 127) the holotype of *tyrrhus*, now in the Berlin Museum, and of which I have seen a coloured drawing sent to Lower, is a female from Cooktown, and not a male, as stated by Mabille. The holotype male and the allotype female of *bathrophora* from Mackay are in the South Australian Museum. Miskin in his collection had this species under *halyzia* Hew.

HESPERILLA MELANIA (Waterhouse).

Telesto melania Waterhouse, xx, Vict. Nat., 1903, p. 54.
Hesperilla melania Low., 1911, p. 126.
Toxidia melania W. and L., 1914, p. 193, fig. 667-9.

The holotype male and allotype female from Kuranda, Queensland, February, 1902 (R. E. Turner), Cairns district, are now in the Australian Museum, Sydney.

HESPERILLA CHRYSOTRICHA CHRYSOTRICHA (Meyrick and Lower).

Telesto chrysotricha M. and L., 1902, p. 59.

Hesperilla chrysotricha Low., 1911, p. 121; W. and L., 1914, p. 188, fig. 631, 776-7.

The holotype is a male in the South Australian Museum from King George's Sound (Albany), Western Australia. A male with the same type of printed label is in the Australian Museum from the same locality. This suggests that it was caught by the late A. S. Olliff. I was not able to see the worn female specimen mentioned by Lower (1911, p. 122) from Goolwa, South Australia, taken in March. The locality and date suggest that it is a form of *donnysa* rather than *chrysotricha,* which is only a spring insect in Western Australia.

HESPERILLA CHRYSOTRICHA CYCLOSPILA (Meyrick and Lower).

Telesto cyclospila M. and L., 1902, p. 63.

Hesperilla cyclospila Low., 1911, p. 121; W. and L., 1914, p. 188 (in part; not fig. 632).

Hesperilla leucospila Waterhouse, Proc. Linn. Soc. N.S. Wales, lii, 1927, p. 280, pl. xxvi, fig. 25-28.

This race has caused some difficulty. M. and L. described it from "Port Lincoln, South Australia; Melbourne, Victoria; two specimens in November." In 1911 this is repeated without the number of specimens and the addition of "Types in Coll. Lower." In November, 1910, Lower lent me three specimens, and his letter reads "1 male, 1 female *cyclospila.* 1 male do., Melbourne." The Melbourne specimen is undated, and the Port Lincoln specimens are dated October. The Port Lincoln male bore his type male label, but it does not agree with the 1902 description, in that it lacks the uppermost silver spot on the hindwing beneath, which is found in his Melbourne male and also rarely in other Victorian specimens.

Although there is no doubt in my mind that the type locality of Port Lincoln was intended, General Evans, Mr. Tindale, and I decided to remove the type label from his Port Lincoln male and place it upon his Melbourne male, as that was the only specimen in the collection that agreed with the description. Thus *leucospila* Waterhouse sinks as a direct synonym and the type locality of *cyclospila* will be near Melbourne.

MOTASINGHA DIRPHIA TRIMACULATA (Tepper).

Hesperilla trimaculata Tepper, Trans. Roy. Soc. S. Aust., iv, 1881, p. 32, pl. ii, fig. 1.

Hesperilla quadrimaculata Tepper, *l.c.*, pl. ii, fig. 2.

Motasingha dirphia Low., 1911, p. 120 (in part); W. and L., 1914, p. 195 (in part).

Having seen Tepper's types of *trimaculata*, a male from Monarto, and *quadrimaculata*, a female from Ardrossan, and compared them with other South Australian specimens at Adelaide, I am convinced that these constitute a race distinct from the typical *dirphia* from Western Australia. It may be distinguished by having the underside more reddish than grey and the silver spots more distinct.

MOTASINGHIA ATRALBA ATRALBA (Tepper).

Hesperilla atralba Tepper, Trans. Roy. Soc. S. Aust., iv, 1881, p. 33, pl. ii, fig. 5.
Motasingha atralba W. and L., 1914, p. 195, fig. 649.

The holotype is a female from Ardrossan, South Australia, and now consists of only two forewings. On a collecting trip to Port Noarlunga in April, 1932, I found larvae and a pupa on *Gahnia lanigera* (R. Br.) Bentham. The larva is somewhat like that of *M. dirphia*, and it pupates head downwards, but without the silken pad, as in *Mesodina*.

Meyrick and Lower's description of *atralba* (1902, p. 71) applies to the race from Western Australia, as amongst other characters the stigma is stated to be strong and blackish. In typical *atralba* it is narrow and very difficult to see.

MOTASINGHIA ATRALBA DACTYLIOTA (Meyrick).

Telesto dactyliota Meyrick, Proc. Linn. Soc. N.S. Wales, ii, 1887, p. 831.

A careful comparison of the original description shows that although Meyrick gave both South Australian and Western Australian localities his description applies only to specimens from Western Australia. Type in Coll. Meyrick.

MOTASINGHIA DOMINULA (Plötz).

Telesto dominula Plötz, Stett. Ent. Zeit., 1884, p. 379.

Previously I had never seen any specimens as large as Plötz's coloured figure from Tasmania, and so doubted that locality. Both the Australian and the South Australian Museums have now specimens from low elevations in Tasmania agreeing in size and markings with the figure. Typical *dominula* will therefore apply to these specimens from Tasmania, whilst *drachmophora* Meyrick, from Mount Kosciusko, is the race from Australia. The locality of Newcastle given by Lower (1911, p. 133) is erroneous, as the race in Australia has never been taken below 3,000 feet. Specimens from high elevations in Tasmania are very much smaller.

HESPERILLA XIPHIPHORA Lower.

Hesperilla xiphiphora Low., 1911, p. 130.
Neohesperilla xiphiphora W. and L., 1914, p. 194, fig. 656.

The holotype male is from Darwin, March, 1909, allotype female from Darwin, February, 1909, in the South Australian Museum, and paratypes in Australian Museum from Darwin.

HESPERILLA XANTHOMERA (Meyrick and Lower).

Telesto xanthomera M. and L., 1902, p. 80.
Hesperilla croceus Miskin, Proc. Roy. Soc. Qld., vi, 1889, p. 150 (female, but not male).
Neohesperilla xanthomera W. and L., 1914, p. 194, fig. 673-5.

The fixation of the type of this species has been attended with great difficulty. The description is based on male 30 mm., female 36 mm., "Brisbane and Cairns, Queensland, two specimens in March and September." Lower's collection contained four specimens, all numbered 3759, which agreed with his register. The only male is from Townsville, of 35 mm. expanse, September, 1900, the date being in Dr. A. J. Turner's handwriting. This agrees with the description, except size and locality, and has been considered as the holotype. A female from Townsville, which had 13 veins on the left forewing, is mentioned in his note, but is over 36 mm. A female from Cooktown, 30 mm. in expanse, in which the fourth spot is confluent with the third, is mentioned as sometimes occurring in the description: this specimen had a female type label, and was recorded in the register as March. These three specimens must have been before Lower when he wrote the description, as at least two females are indicated. The fourth specimen was from Brisbane, and may possibly, though doubtfully, have been added after the description was written.

Nevertheless, taking into account Lower's carelessness in respect of many of his descriptions, it seems obvious that the Townsville male must be considered as the holotype. The species, as was well known to Lower, is much more common in Brisbane than elsewhere in Queensland.

BIBLA ANISOMORPHA Lower.

Bibla anisomorpha Low., 1911, p. 146; male.
Taractrocera anisomorpha W. and L., 1914, p. 201, fig. 883-4.

Lower's holotype is a male from Port Darwin, March, 1909; the specimen he had labelled as the female is also from Port Darwin, but is the male of a very distinct species, *Taractrocera ina* Waterhouse. This is a rare species; in the South Australian Museum it is also from Roper River, Fortescue River, and Gayndah. I have it also from Mackay and Westwood, near Rockhampton.

TARACTROCERA INA Waterhouse.

Taractrocera ina, Proc. Linn. Soc. N.S. Wales, lvii, 1932, p. 228.

The holotype of this species is a male in the South Australian Museum, and is the specimen which Lower marked as his type female of *Bibla anisomorpha.*

OCYBADISTES HYPOMELOMA Lower.

Ocybadistes hypomeloma Low., 1911, p. 152.
Padraona hypomeloma W. and L., 1914, p. 204, fig. 584, 873-4.

Lower described both sexes, but his locality note is badly punctuated, and should read: Herberton and Kuranda, Queensland in March, one female (Dodd); Roseville, near Sydney, two male specimens in April (Waterhouse). Lower added that the types were in his collection. On examination it was found that he had a female from Kuranda, March, 1907, with a label in his handwriting, "*hypomeloma* type female." He also had a male from Herberton, January 31, 1911, but it was not marked as the type male, nor did it agree with his description, and was without doubt added to his collection after his description was written. The difficulty regarding his type male was settled by a specimen in my collection from Roseville, April 4, 1904, bearing in Lower's handwriting a label, "*hypomeloma* type male Lower." I had this specimen with me in Adelaide, and it agreed with the description in having the upper two of the five spots of the discal band of the forewing half the size of the remaining three and the small somewhat ovoid spot lying on vein 6 of hindwing well separated from the oblique band. If further proof were wanting it is supplied by a letter from Lower to me dated April 20, 1911, in which he says: "I am sending the female *hypomeloma.* I have no male, so that your male will be the type male, my female the other sex. You will perceive that the female came from Dodd."

The holotype male is without doubt the specimen marked as type male by Lower from Roseville, near Sydney, and is now in the Australian Museum, Sydney, and the type locality will be Sydney.

OCYBADISTES WALKERI HYPOCHLORA Lower.

Ocybadistes walkeri hypochlora Low., 1911, p. 149.
Ocybadistes flavovittata hypochlora W. and L., 1914, p. 204, fig. 860, 867.

The holotype male and the allotype female are from Parkside, Adelaide. It has been shown (W. and L., 1914, p. 203) that the name *flavovittata* must be applied to the common small orange and brown Hesperiid found at Sydney, and not to *agraulia* Hewitson from Western Australia, as Lower has done. Mr. N. D. Riley (Trans. Ent. Soc. Lond., 1926, p. 239) confirms this.

PADRAONA HETEROBATHRA (Lower).

Apaustus heterobathra Low., 1908, p. 316.

Padraona heterobathra Low., 1911, p. 154; W. and L., 1914, p. 202, fig. 872.

Holotype male is from Kuranda, April, 1907, allotype female, Kuranda, March, 1907, in South Australian Museum. General Evans has pointed out to me that this species, though without a sex brand, has sex scales over vein 1, on either side of vein 2, and below vein 3, and also that it must be placed as a race of *ardea* Bethune-Baker, Ann. Mag. Nat. Hist., (7) 18, 1906, p. 343.

PADRAONA LASCIVIA (Rosenstock).

Pamphila lascivia Rosenstock, Ann. Mag. Nat. Hist., (5), xvi, 1885, p. 378, pl. xi, fig. 1.

Apaustus lascivia M. and L., 1902, p. 100.

Padraona lascivia, Low., 1911, p. 153; W. and L., 1914, p. 202, fig. 587-8.

The holotype is a male from Beaconsfield, Victoria, in the South Australian Museum, from the Lucas Collection. In the paper in which this species and *Telesto scepticalis* are described, Rosenstock states that the specimens were from South Australia, received from Dr. Lucas, of Melbourne. This is another instance of the confusion of South Australia with southern Australia.

TELICOTA AUGIAS MESOPTIS Lower.

Telicota augias mesoptis Low., 1911, p. 157.

The holotype male and allotype female are from Kuranda, April, 1907. A discussion on the *augias*-like species must await further investigation, as there are probably three or more different species passing under this name in Australia, and descriptions under at least five different names have been given of Australian specimens.

TELICOTA ANISODESMA Lower.

Telicota anisodesma Low., 1911, p. 157.

The holotype is a male from Ballina, Richmond River, caught by myself, and is at Adelaide. I have similar specimens from the same locality and also from South Queensland.

TELICOTA EURYCHLORA Lower.

Telicota eurychlora Low., 1908, p. 314; W. and L., 1914, p. 210, fig. 692-3, 861.

The holotype male and allotype female from Ballina, Richmond River, February, 1898, are in the Australian Museum, Sydney.

TELICOTA BRACHYDESMA Lower.

Telicota brachydesma Low., 1908, p. 312; Low., 1911, p. 159; W. and L., 1914, p. 209, fig. 671-2, 878-9.

The holotype male and allotype female from Cooktown, labelled so in Lower's handwriting, are in the Australian Museum, Sydney. Lower's note (1908, p. 314) is correct that the types were in Coll. Waterhouse, and incorrect (1911, p. 159) when he said that they were in Colls. Lower and Waterhouse.

CORONE TRICHOPEPLA (Lower).

Erynnis trichopepla Low., 1908, p. 315.
Erynnis palmarum M. and L., (*nec* Moore), 1902. p. 110.
Cephrenes trichopepla W. and L., 1914, p. 207, fig. 676-7.

The holotype is a male from Mackay in the South Australian Museum. General Evans considers that this may have had a common origin with *palmarum* Moore, but is sufficiently distinct to rank as a species.

HASORA ALEXIS CONTEMPTA (Plötz).

Ismene contempta Plötz, Stett. Ent. Zeit, 1884, p. 56.
Parata chromus M. and L. (*nec* Cram), Low., 1911, p. 169.
Ismene lucescens Lucas, Proc. Roy. Soc. Qld., 1899, p. 138.
Parata chromus contempta W. and L., 1914, p. 217, fig. 729-30.

The holotype male and allotype female of *I. lucescens* are in the South Australian Museum from South Queensland ex Lucas Collection. General Evans has shown that *alexis* Fabr. is the name of the typical race of this species, and that after examining the long series in the Lower Collection at Adelaide he is convinced that they are all the same, and that Lower had no justification in making two, if not three, species from his series.

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ABORIGINES OF PRINCESS CHARLOTTE BAY, NORTH QUEENSLAND

By HERBERT M. HALE (Director) and NORMAN B. TINDALE, B.Sc. (Ethnologist).

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INTRODUCTION.

In December, 1926, the Board of Governors of the South Australian Museum sent the writers to Southern Cape York Peninsula, North Queensland, with the object of elaborating the hitherto meagre Museum collections from this locality.

January and February, 1927, were spent at Flinders and Stanley Islands, Bathurst Head, Stewart River and Silver Plains, and on the shores of Princess Charlotte Bay.

Our first station was on Flinders Island, where a small hut had been erected to accommodate stores required by trepang and pearling fleets working on the Great Barrier Reef. The fortnight set aside for marine work at this island was extended to five weeks, owing to the detention of our cutter by cyclonic weather near Cooktown. Fortunately, natives of several tribes visited the island, while

the extended stay permitted visits to many nearby places of interest. A shortage of food necessitated journeys to other islands and to the adjoining mainland in order to obtain dugong, kangaroos, shell fish, and other native delicacies to eke out our depleted supplies.

When the cutter returned we visited the Stewart River district, and spent several weeks at the mouth of the Stewart and at Silver Plains, some five miles inland. A few days were spent at Flinders Island on the return journey, and, after a protracted delay in Cairns, due to the passage of the Willis cyclone, we left North Queensland for Adelaide in April.

The following notes were gathered in the intervals of marine and general zoological research, which fact serves as an excuse for, and an explanation of, their incompleteness.

GEOGRAPHICAL DESCRIPTION.

Princess Charlotte Bay is a large, northwardly-directed indentation in the east coast of Southern Cape York Peninsula. It is everywhere shallow and muddy and, except at its sandy western extremity, is lined with a dense fringe of mangroves. Several large rivers flow into the Bay from the south and south-west, and their deltas form extensive areas of swampland, lagoon, and mud-flat. The country east of Princess Charlotte Bay is a gently rising plain extending to the Main Cape York Dividing Range; it is covered with open forest, swamps, and in isolated places with dense riverine jungle and tropical rain forest.

The country east of the Bay between Bathurst Head and Cape Melville is a dissected plateau of horizontally bedded sandstone of Triassic age, resting on a pavement of massive granite, and culminating in the rather inaccessible Altanmoui Range, over 2,000 feet in height.

The Flinders Islands, to the north of Bathurst Head, are outliers of this dissected plateau; they rise in steep red sandstone cliffs on almost all sides, and owing to the sterility of their scant soil vegetation is sparse. The highest peak on Flinders Island is 1,051 feet in height. There are several small depressions on its bare sides which contain pockets of soil, wherein yams and other plants may grow, otherwise the whole aspect is one of infertility and aridity. The relative dryness of the island climate may be judged by the fact that in the wettest months of the rainy season (January-February) less than an inch of rain fell, although during the same period some thirty inches were recorded at Stewart River. This may be accounted for by the fact that during the north-west monsoon this group is on the lee of the Cape York Peninsula. Flinders Island is skirted by number-

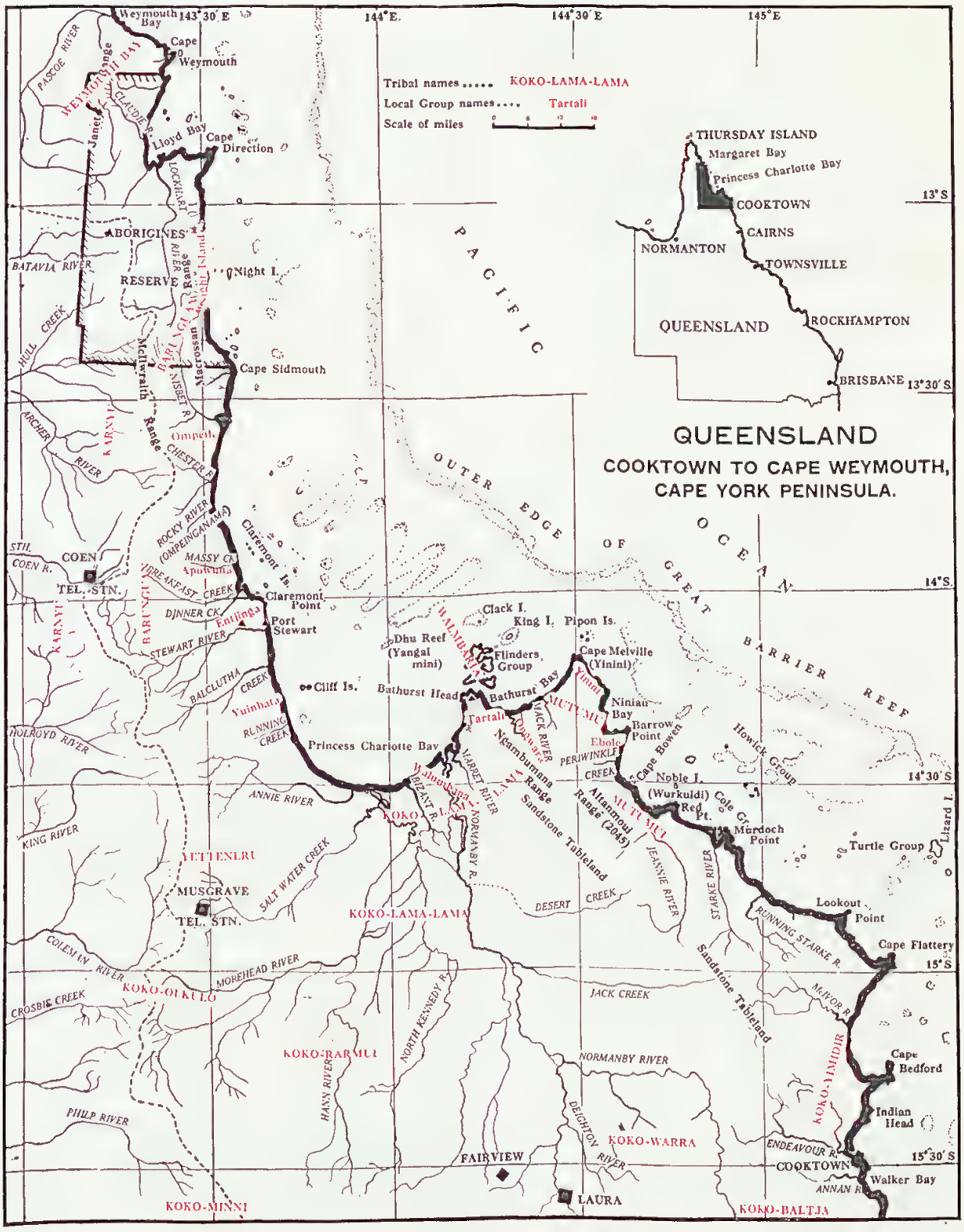
QUEENSLAND
COOKTOWN TO CAPE WEYMOUTH,
CAPE YORK PENINSULA.
Tribal names..... KOKO-LAMA-LAMA
Local Group names.... Tartali
Scale of miles
143°30' E
144°E.
144°30' E
145°E
13°S
13°30' S
14°S.
14°30' S
15°S
15°30' S
THURSDAY ISLAND
Margaret Bay
Princess Charlotte Bay
COOKTOWN
CAIRNS
NORMANTON
TOWNSVILLE
QUEENSLAND
ROCKHAMPTON
BRISBANE
PACIFIC
OCEAN
OUTER EDGE OF GREAT BARRIER REEF
Weymouth Bay
Cape Weymouth
Lloyd Bay
Cape Direction
ABORIGINES RESERVE
Night I.
Cape Sidmouth
COEN
TEL. STN.
Claremont Point
Port Stewart
Clack I.
King I.
Pipon Is.
Dhu Reef (Yangal mini)
Flinders Group
Cape Melville (Yinini)
Cliff Is.
Bathurst Head
Bathurst Bay
Ninian Bay
Barrow Point
Princess Charlotte Bay
Cape Bowen
Noble I.
(Wurkuldi)
Red Pt.
Cole Group
Howick Group
Murdoch Point
Turtle Group
Lizard I.
Lookout Point
Cape Flattery
Cape Bedford
Indian Head
Walker Bay
COOKTOWN
MUSGRAVE
TEL. STN.
KOKO-LAMA-LAMA
FAIRVIEW
LAURA
KOKO-WARRA
KOKO-MINNI
KOKO-BALTJA
KOKO-OLKOLO
KOKO-BARMIL
KOKO-TIMIDIR
Sandstone Tableland
Atlanmoul Range (2045)
Ngambumana Range
Walbuthana
Tartali
Ebolo
Yinini
MUTTI MUTTI
PERIWINKLE CREEK
JACK RIVER
MARRET RIVER
NORMANBY R.
DESERT CREEK
JEANNIE RIVER
STARKE RIVER
RUNNING STARKE R.
JACK CREEK
NORMANBY RIVER
DEIGHTON RIVER
ENDEAVOUR R.
ANNAN R.
HANN RIVER
NORTH KENNEDY R.
MEIVOR R.
PASCOE RIVER
JANET CREEK
CLAUDIE R.
LOCKHART R.
BATAVIA RIVER
HULL CREEK
McILWRAITH Range
MACROSSAN Range
NISBET R.
ARCHER RIVER
KARAMA
CHESTER R.
Ompeli
ROCKY RIVER (OMPEINGANAMA)
MASSY CK
Apudunta
BREAKFAST CREEK
DINNER CK
Entinga
STEWART RIVER
BALCLUTHA CREEK
Yuinbata
RUNNING CREEK
HOLROYD RIVER
ANNIE RIVER
KING RIVER
SALT WATER CREEK
COLEMAN RIVER
MOREHEAD RIVER
CROSBIE CREEK
PHILP RIVER
COEN R.
STH.
BARAMBAH
WALAMBAHANA
KOKO-

Fig. 1.

less coral reefs and islets of the Great Barrier Reef. Each affords a variety of marine foods for the native inhabitants.

Drinking-water is scarce, although a few permanent native wells exist, and there is stated to be a submarine fresh-water spring off Denham Island.

The Flinders Groups and vicinity were first noticed by King (1), who made no fewer than three visits to Princess Charlotte Bay. His description is summary: "Cape Flinders . . . is the extremity of a group of islands of high and rugged character forming the western head of Bathurst Bay." King saw evidence of the presence of natives on Stanley Island, and in several places mentions having seen natives, or evidences of recent camps, there.

Remains of early shipwrecks occur on the coasts of the island, and have provided the natives with a supply of iron for several generations. Therefore no evidence of the use of stone tools remains.

Despite its stern appearances the Flinders Group has been visited by several exploring vessels. The ship *Fly* was there in 1843; the ship *Bramble* cruised for ten days in the Bay in August 1838, while waiting for the explorer Kennedy, who, during his overland trip to Cape York, was apparently the first to examine the interior of the country. Hann explored the coast at Stewart River in 1872. Roth visited Princess Charlotte Bay, but as far as can be ascertained from his writings the greater part of his notes refer to the natives of the mainland tribes. The ships *Alert, Rattlesnake,* and *Dart* also engaged in zoological and other researches along this coast.

European occupation was stimulated by the discovery of extensive goldfields in the Coen district, but since the exhaustion of the richest alluvial claims the country has been largely abandoned. The natives were early affected by European contacts, but have in part reverted to their former state. This is especially true of the inhabitants of the less inviting coastal areas.

PLACE NAMES.

Place names vary from tribe to tribe. Roth (2) has recorded names for some of the geographical features of the Princess Charlotte Bay area in the language of the Koko-warra, an inland tribe. This nomenclature is dissimilar to that employed by the coast tribes for places within their own bounds. The names on the accompanying maps (fig. 1-2) are in every case those applied by local members of the tribal group.

(1) King, Philip, Survey of Australia, i, 1827, p. 230.

(2) Roth, Rec. Aust. Mus., viii, 1910, p. 94.

TRIBES.

Natives of six tribes were met with, and random notes relating to others were gathered. Our principal contacts were with natives of the Mutumui, Walmbaria, Kokolamalama, and Barunguan tribes. The accompanying sketch map (fig. 1) indicates the general distribution of the tribes. Definite boundaries cannot be marked off by means of lines; if the map were coloured it would,

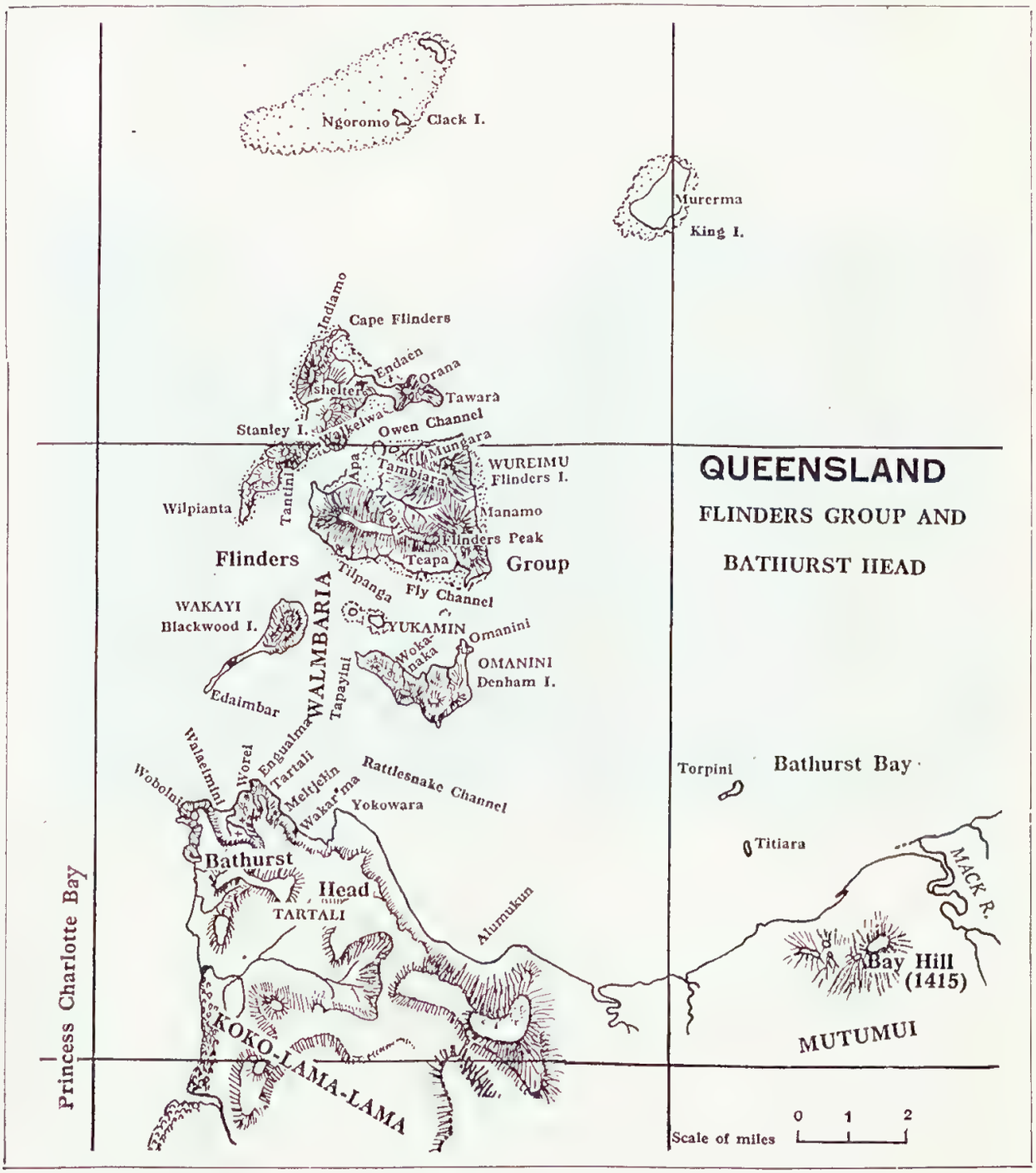

Fig. 2.

as a rule, be necessary to run the colours one into another in order to indicate symbolically the indefinite divisions between the peoples.

The Mutumui people, in the south-eastern part of the area under consideration, are shore-dwellers, frequenting the coastal plain between Murdoch Point and Bathurst Bay. Barrow Point and Periwinkle Creek are among their chief camping places. The tribe is divided into several small local groups or clans, each of which claims one or a pair of totems. Each clan or totem kin may be referred to either by the name of the chief locality or, not so frequently, by the name of the principal totem. Each of these clans speaks a slightly different dialect of the same language, called Eibole (Ebole or Eipolin). This name is also applied in the form Eibole to one of the surviving clans.

Fig. 3. Native pad, coast of Princess Charlotte Bay.

The Ongwara clan camp is principally at Mack River, the Yinini at Cape Melville, the Eibole at Barrow Point. Other groups, members of whom we did not meet, are stated to occur at Noble Island, the Wurkuldi, and at Starke River, where the language was said to change very much.

The Yinini clan (Cape Melville) are known to the Kokolamalama people as Baulam (or, according to one old man who had a peculiar enunciation, Basthom). The Mutumui are essentially a coastal people, and only visit the sandstone table-

land country to gather honey and hunt opossums and rock wallabies. Their native tracks or pads extend everywhere along the coast, turning inland only when necessary to avoid rocky cliffs (fig. 3). Their water supplies are obtained chiefly in little soaks along the beaches.

The Ongwara section of the Mutumui people, who live in the country near and behind Bathurst Bay, refer to the Yinini as 'alei,' or saltwater. They apply the same term to the Walmbaria.

A Kokoyimidir woman, from near Cooktown, knew the term Kokonegodi (of Roth) as one applied to the Mutumui by the Cooktown people; it is not known to the Mutumui themselves.

The Flinders Islands and Bathurst Head are occupied by the Walmbaria tribe, which is divided into two principal clans, the Wureimu, who live on the islands, and the Tartali, of Bathurst Head. The southern boundary of the tribe lies between Alumukun in Bathurst Bay and the eastern extremity of Princess Charlotte Bay. Their language is called Yalgawara, and the natives distinguish a Tartali dialect used only by the mainland section of the tribe. Names applied by others to this tribe are Wonkayi, Retjringa, and Mba. The two last-named are Kokolamalama terms. The Walmbaria are a fishing people, living principally on shore-fishes, molluscs, crustaceans, and occasional dugongs and turtles. Vegetable foods are relatively scarce, and the consequent carbohydrate hunger leads them to consider such food the greatest of luxuries.

Denham Island (Omanini) was once inhabited by a special group of Walmbaria natives who are now extinct. There was an important camping place at Wokanoka beach, on the northern side. Water is found at Omanini Point; the natives tell of a fresh-water spring below sea level. At high tide they dive down and drink; at other times they lower shell buckets into the sea to obtain supplies.

Blackwood Island (Wakayi) was never permanently inhabited, but there is a large camping place at the northern end, which is used when fishing excursions are made to the island.

The Kokolamalama are inhabitants of the banks of the Normanby and North Kennedy Rivers. Their coastline is swampy and mangrove-lined, so that they are largely an inland people, but they do not extend beyond the tidal limits of the rivers.

The term Kokolamalama is really the name applied to them by a more southern tribe; they call themselves Bakanambia and Wanbara. Those who live near Jane Table Hill, and who are in close contact with Walmbaria people, sometimes call themselves Walumbana or Mbawalmbaria. To the south-west they are in contact with the Koko-rarmul people described by Roth.

The Koko-warra tribe of Roth was known by contact to members of the Koko-

lamalama, with whom we conversed at Bathurst Head. They were said to live on the upper waters of the Normanby River and to extend as far as Laura. Their main camp was at a place called "Daidan," which the authors have since recognized as being the Deighton River. This is probably the "Laura-Deighton" tribe, whose brass "king plate" was accidentally kicked up out of the sand by one of us on a beach at Flinders Island.

The Yetteneru tribe live west of the Kokolamalama, along the Saltwater Creek and Annie River. They are called the "salt pan blackfellows" by natives speaking English, and use a dialectic variation of Kokolamalama. They are nearly extinct, only one old man and five women remaining alive in 1927. There were two clans, one on the seashore and one inland, but little could be learned about them.

The Barunguan tribe extends along the coast from Running Creek in the south nearly to Cape Direction. Kokolamalama names for the tribe are Baa and Banjingam. The Karnyu, an inland people, call them Baka. There are at least five local groups or clans who claim this tribal name. The southernmost is the Yuinbata, who frequent the country south of Stewart River, on the southern bank of the mouth of which they make their northernmost camp. Their main camps are on Balclutha Creek.

The Entjinga live along the banks of the Stewart River, the mouth of which is also known as Entjinga. Formerly they ranged inland, in search of honey and small game, for some thirty miles, but since the stocking of the main range with cattle they have been compelled to confine themselves to the relatively infertile sand beaches, coastal swamps, and mangrove-lined foreshores. At Entjinga they camp only on the northern bank of the river.

The Apowuna (also called Konanununa) clan have their main camps along Massey River. In recent years they have become greatly diminished in numbers, and have linked themselves with the Entjinga survivors, although they still keep their camps about fifty yards apart.

The Ompeila range from Rocky River (Ompeinganama) northward to the Nisbet River. Some of their main camps are on the Rocky River, and a permanent lagoon one mile north of the mouth of the river is also an important camping ground.

Dialectic variations occur in the languages of these clans. Thus the Yuinbata word for water is 'opola,' the Entjinga is 'ipi,' and the Ompeila is 'pii.'

North of the Ompeila is the "Night Island" group, about which little was learned, except that they intermarry with the other clans of the Barunguan and speak practically the same dialect as the Ompeila. North of the Night Island people were other tribes, the language of which was not known to the informant, a Night Island woman named Oreji, who was married to an Entjinga man.

The Karnyu (Karnju, Karnu, Karntju) tribe is an inland group belonging to the main dividing range country between Coen, the headwaters of the Archer River, and the sources of the Lockhart. They were formerly at enmity with the coast tribes on both sides of the Peninsula. Our acquaintance with them is slight and based on brief conversations with a man at Stewart River. A few examples of their vocabulary recorded in the word lists, and some other facts, indicate the possibility of a definite break in type of social structure and relationships between these two groups.

TYPES OF PEOPLE.

The coastal natives of Princess Charlotte Bay and Flinders Island are of medium stature, seldom attaining 5 ft. 7 in. in height. Many of them are relatively small, with statures of 5 ft. 1 in. to 5 ft. 2 in. No detailed measurements were secured.

Their bodies are stout and muscular, but, as is usual in Australian tribes, the thighs and legs are relatively thin. The body colour may be of two distinct shades of brown, either very dark or a lighter shade. Body hair varies from scant (the usual condition) to a far rarer moderately hairy condition.

The head hair varies from low waves (kymatotrich) to spiralled (ulotrich), the inland and southern people possessing on the average straighter hair than those on the coast. A dark skin and ulotrichous hair is very characteristic of the Walmbaria survivors, as well as some of the Princess Charlotte Bay peoples.

Among the thirty-four people with untrimmed hair at Flinders Island (coastal Walmbaria, Kokolamalama, and Mutumui tribes) the estimated proportion of hair types according to Martin's scheme ([3]) was as follows:

Kymatotrich	d	2	6%
	e	3	9%
	f	13	38%
Ulotrich	g	10	30%
	h	6	18%

Fig. 4-7 show full-face and profile views of two Walmbaria men. Wondal, the last adult male survivor of the Stanley Island group (fig. 4-5) has ulotrichous hair of the type h. His skin was of the darker shade and his body was relatively hairy. Further north on Cape York an even greater proportion of the natives have frizzy hair. Fig. 45 depicts four men of the upper Archer River whom we met. Three of them have markedly ulotrichous hair.

([3]) Martin, R., Lehrbuch der Anthropologie, 1928, vol. I, p. 214, fig. 79,

Fig. 4–7. Walmbaria men, (4–5, Stanley Island; 6–7, Bathurst Head). Fig. 8–11. Kokolamalama men, (8-9, Jane Table Hill; 10-11, Normanby River).

Fig. 12–19. Mutumui men. (12–13, Mack River; 16–17, Cape Melville; 18–19, Barrow Point).

Fig. 34-42 depict Walmbaria women. Where the hair remains uncut it is usually deeply waved on the borders of ulotrichy. In later life, after continued cutting, it appears to be less curled.

Kokolamalama men are depicted in fig. 8-11. Mutumui men are shown in fig. 12-19, women in fig. 24-33, and children in 44. Fig. 20-23 show full-face and

Fig. 20–21. Barunguan man, and fig. 22–23, Barunguan woman (both Stewart River).

Fig. 24–33. Mutumui women. (24–27, Cape Melville; 28–31, Cape Bowen; 32–33, Barrow Point).

Fig. 34–43. Walmbaria women (34–39, Flinders Island; 34–43, Bathurst Head).

profile views of a Barunguan man and woman from Stewart River; the women shown in fig. 46-47 and 50 and the children in fig. 49 are from the same locality.

Marked assymetry of the breasts was a noticeable feature among the women of the Barunguan group; in all the cases observed the left breast was of small dimensions as compared with the right. Fig. 50 depicts one of the less marked instances.

Fig. 44. Mutumui children.

Fig. 45. Men from Upper Archer River; three have markedly ulotrichous hair.

MUTILATIONS.

Tooth evulsion is practised among the Walmbaria and Barunguan, either the right or left upper central incisor being removed in all members of both sexes. Fig. 47 depicts a Barunguan young woman with the right upper central missing.

A broad short transverse cicatrice is generally cut on the upper chest of Walmbaria males; this may be followed by a second or third. In recent years the practice has tended to lapse.

Long, thin, transverse abdominal cicatrices were the fashion at Stanley Island, as well as numerous short vertical marks on the upper and outer part of each arm; typical examples are shown in fig. 4-5.

The Barunguan of both sexes commonly cut transverse scars on the lower part of the chest, as well as one or more rows of vertical cicatrices on the upper

arms. Also they sometimes pierce the lobes of their ears, and keep them distended with pieces of wood, but the practice was never universal, and has been largely abandoned by the younger generation.

Mutumui, Walmbaria, and Barunguan people pierce the nasal septum, and commonly wear short, transverse, wooden nose-plugs or longer curved shell ornaments through the hole. The effect of this mutilation is seen in fig. 46 and 48.

Circumcision is not known or practised among any of the tribes met with at Princess Charlotte Bay, and no operation is practised on adolescent girls.

POPULATION.

In 1926 there were no living children of the Walmbaria tribe, the youngest person then being a youth about eighteen years of age. Some ten males and fifteen females survived, a few on the island and the others at Bathurst Head. The total area of their country was little more than 30 square miles (of which 10 miles was included in the islands, the rest being on the mainland).

Fig. 46. Barunguan woman, showing pierced nasal septum; Pt. Stewart.

Fig. 47. Barunguan woman, with incisor tooth removed; Pt. Stewart.

Genealogies show that in previous generations the average number of children per family reaching their majority was 3·2 (average of seven families). In two families there were five surviving children.

Indications suggest that the tribal boundary has remained constant within the memory of the present natives, but that the population has decreased. The family lists show that two generations ago there were between thirty and forty

people on the islands and about thirty at Bathurst Head, the larger number on the island being determined primarily by the greater available area of food-providing coast and reef. The population, two per square mile, was dense, considering the sterility of the sandstone tableland, which constitutes the major part of the area.

Fig. 48. Walmbaria woman with wooden nose peg; Flinders Island.

The depletion of the tribe in the present generation has been partly obscured by a northward drift of adult Mutumui people accompanied by two children. The country of these people has been adversely affected by the advance of cattle stations in the south.

In a Kokolamalama camp at Princess Charlotte Bay only few children were seen.

Fig. 49. Barunguan children, Stewart River.

Fig. 50. Barunguan woman, Stewart River.

At Stewart River few opportunities for study of the population occurred. The Yetteneru tribe is almost extinct, and the survivors could give us little idea of its former numbers.

Several children were present in the Barunguan camp, but only one family had more than two. At least eight women of child-bearing age had no surviving children, although they had had numerous pregnancies. No estimate of the present or former population can be given.

SOCIAL ORGANIZATION AND TOTEMS.

Walmbaria Tribe.

Brief observations made on Flinders Island suggest that the basis of the social organization in the Walmbaria tribe is a two-class system, either degenerate or imperfectly developed, and now falling into disuse.

The two classes are now always referred to by the names applied also to the principal totems, namely:

a. Owaimini.
b. Ungawu.

One suspects that formerly other names were known; in the Barunguan tribe the terms Karpia and Koiana are still used. This dichotomous organization is associated with patrilineal descent and patrilocal marriage.

As in some other areas where only moeities and totems occur, the reckoning of descent is simple, the child (male or female) taking the moeity, the totem, and the totem country of its father. The totem kins are strongly localized and are exogamous.

The totems are comparatively few in number in each of the tribes under consideration, and each tends to be strictly localized in some particular part of the tribal area. The following occur in the Walmbaria tribe:

Class A.	*Class B.*
Owaimini (kangaroo):	Ungawu (native companion):
Stanley Island and Flinders Island.	Bathurst Head.
Arkeita (whale):	Rokalu (red kangaroo):
Flinders Island.	Denham Island.

The Rokalu people of Denham Island are extinct. Some of the people claim both kangaroo and whale totems; they regard Owaimini as being more important to them than Arkeita. An emu totem also formerly existed on Flinders Island, but details were not obtained.

Flinders Island men and women talk freely of Owaimini as their totem, and it is only on close questioning that the subsidiary totem 'arkeita' will be mentioned. This subsidiary totem is possessed by all individuals. There is one woman who claimed to be arkeita alone, but this was not supported by other members of her tribe. Strict prohibition of the eating of the kangaroo exists among all these people, but does not extend to the whale totem; if one of these giant mammals were stranded, everyone would eat of it. At Bathurst Head the native companion is not eaten.

In the Walmbaria tribe a man was permitted to marry his mother's brother's daughter or a person who stood in the same relationship, and the former normal method of marriage was for two men suitably related to exchange sisters. These notes disagree with Roth (4), who states that throughout North Queensland mother's brother's daughter, and father's sister's daughter, are prohibited marriages. Since the breaking-up of the tribe organization, and the decimation of the tribe, this practice has been practically abandoned in favour of more indiscriminate unions with individuals of remote tribes. The wife of one Flinders Island native is from Cooktown, another woman is from Night Island, a third from Saltwater Creek.

The kinship system, unlike that of the Kokoyimidir recorded by Roth (5), makes no distinction between younger and older brothers and sisters and between mother's younger and older brothers and sister. A brother and sister apply the same terms, 'ambui' and 'arwui,' to a sister's children. There are four terms for the second ascending generation. The same terms probably apply to the second descending generation, but are not shown in any of the genealogies we obtained. In the accompanying diagram the Walmbaria terms, so far as known, have been set out on the framework first devised by Fry (6) during an Anthropological Expedition to Central Australia in 1929.

The list of kinship terms is not exhaustive, and one or two of them are open to criticism. The term 'kagai,' obtained for both mother's and father's brother, may be incorrect in so far as it applies to father's brother. The latter has another term, 'oayi,' which is probably the more correct one. One female informant apparently gave us the terms 'ambui' (son) and 'arwui' (daughter) with the meanings transposed; this may be due to a misunderstanding or to a clerical error. The term 'purugai' was given to us once as being applied to brother's children, but this usage was not confirmed.

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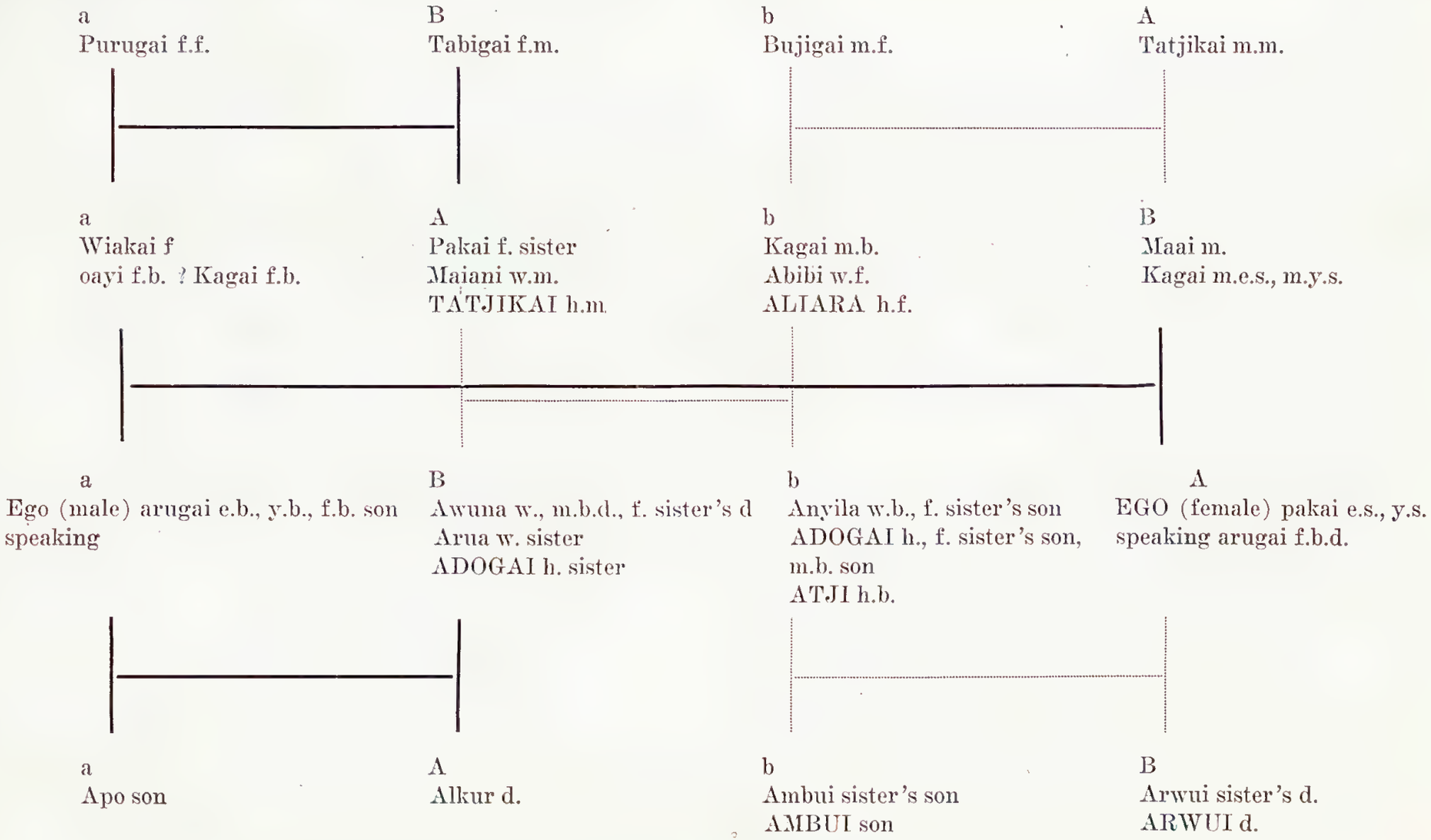
(4) Roth, Rec. Aust. Mus., viii, 1910, p. 102.

(5) Roth, North Qld. Ethnography, ii, 1901, p. 10.

(6) Fry, Trans. Roy. Soc., S. Aust., lv, 1931, p. 17.



Kinship terminology of the Walmbaria Tribe: Male speaking, printed in lower case; female speaking, in upper case. The horizontal bars indicate marriages, the vertical lines join generations. Thus: a, a male, marries B, the children are a and A.

The obtaining of detailed genealogies was laborious, owing to the marked reluctance with which the natives spoke of the dead. This factor, and the rapid degeneration of native custom which has occurred since European contact, indicate that only a limited time remains for useful work in this field of study.

Other Tribes.

In the Mutumui tribe there appears to be a similar social organization to that of the Flinders Island people. There are no less than six localized totem groups, each of which may have a subsidiary totem. Our information is insufficient to explain the details, but the following is a list of the totems obtained:

A.	B.
Wiyara (dugong):	Karuyen (frilled lizard):
Cape Melville.	Inland from Barrow Point.
Wiyara (+Karuyen, frilled lizard):	Tokanba (black kangaroo):
Cape Melville.	Mack River.
Wiyara (+Ngapoyi, leathery turtle):	Tokanba (+Arundi, white pigeon):
Cape Bowen.	East of Mack River.
Arayil (loggerhead turtle):	Yalnga (shell turtle):
Noble Island.	Cape Melville.
Yerkunguru (emu):	
Mack River.	

In addition there was one totem about which our informants were themselves in doubt, namely, 'alpongora' (pelican), from Yokowara, east of Bathurst Head. Marriage is patrilocal, and the children inherit the totem and totem place of the father. The totem animal is never eaten.

The only Kokolamalama totems which we are able to record are:

A.	B.
Alputa (dugong):	Kurkur (native companion):
Jane Table Hill.	Jane Table Hill.

There is a prohibition against eating the totem animal. The country of the dugong people extends somewhat further inland than that of the native companion people, so that their temptation to indulge is lessened by their lack of opportunity.

Our stay at Stewart River yielded few opportunities for enquiries into social organization.

MARRIAGE CUSTOMS.

At Port Stewart the people of the Entjinga and Yuinbata local groups were found in mourning, for recently an old man of the latter group had been buried. Their hair had remained uncut for several months, and they were wearing numerous objects of mourning, including pendants and wooden tablets. Shortly after our arrival a brief ceremony was held, at which the principal event was the cutting off of the hair of all the individuals in mourning; this was followed by a feast, for which food had been accumulated for several days. The objects of mourning were then destroyed or discarded, except by the widow, who still wore them when the writers left Port Stewart. During a period of general mourning no marriages take place, but the ban is lifted after the hair-cutting ceremony.

In the Mutumui tribe a woman whose husband dies becomes the wife of her former husband's brother, and if she proves unsatisfactory may be passed by him to a father's brother's son. The wife leaves the tribe in which she was born and enters that of her husband; children always belong to the tribe of the father.

If a Yetteneru man deserts his wife she may return to her tribe, and may temporarily succeed in keeping the children; the sister of the former husband, however, may become largely responsible for securing food for them.

Tooth evulsion is practised by the Walmbaria and Barunguan (fig. 47), and it is considered proper that all men and women should have parted with an upper incisor before marriage takes place.

In the Barunguan tribe a man is compelled to provide frequent contributions of animal food for his wife's mother, with whom he is not permitted to have any direct contact or conversation.

A Walmbaria man paints the body of his future mother-in-law with ochre as a sign of betrothal to the daughter. From this time on he provides food for the daughter, and after the marriage continues to contribute food to his wife's father and mother as well.

If a child is born after its mother has been travelling in the country of some group or tribe other than that of the father, the child may be recognized as belonging to that country, for the mother remembers the time when the child suddenly entered her. It was asserted too that it would also receive the totem of that country. In the only concrete example provided the contrary was the case, for a Flinders Island boy, whose country was Mack River, retained the owaimini totem.

INITIATION.

The first step in the initiation of the adolescent Walmbaria lad takes place at the age of about eleven or twelve years. Up to this time he has had much free-

dom of association with his sisters, his mother, and other individuals of the opposite sex. The advent of initiation is marked by a series of events of great dramatic force, which appear to impress on the child the beginning of a new life period. The ceremony commences when he is suddenly secreted in a mangrove swamp, or in a hole in the rocks, by a group of women, who stand guard over the spot, and try by various subterfuges, such as erasing his footprints, to disguise his hiding-place. A body of men then appear. They are decorated with pipe-clay sprinkled in the hair, broad transverse bands of colour on the chest, and long curved nose-bones and feather plumes; armed with newly-painted fighting spears, they rush to the spot and forcibly remove the child, or children, amid the screams and mock heroics of the women-folk.

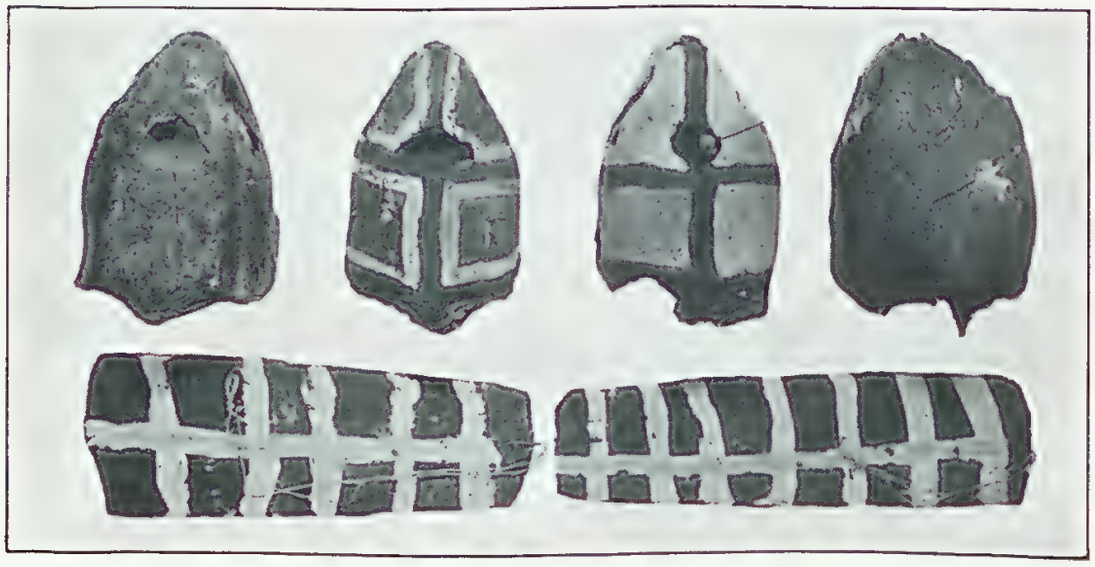


Fig. 51–54. Decorated turtle skulls; Walmbaria tribe, Stanley Island.
Fig. 55–56. Wooden "rain-makers"; Mutumui tribe, Barrow Point.

The child now becomes attached to an individual, usually a father's brother ('oayi'), who instructs him in the various arts of manhood. For some months he is forbidden to speak to the women-folk of the camp, and is thus subject to a series of rules of ceremonial avoidance. For instance, in walking in the bush he must not follow the tracks of any women, even if they be old. His ears may be pierced, and one of his upper incisors is removed; as before mentioned, circumcision is not practised. When he is of age, he is given a wife, for whom he has promised, or given in exchange, a sister, or a father's brother's sister. The girl he obtains is usually about his own age, or somewhat younger. The understanding whereby he has obtained her may be of old standing; at Stewart River the

parents may arrange a conditional marriage for their infant son during the pregnancy of a mother, on the chance that the unborn infant is a girl.

The principal event in the life of the young Walmbaria initiate occurs when he has so far profited by the instructions of his oayi that, unaided, he has killed his first turtle or dugong with harpoon and line. The animal so obtained is eaten at a ceremonial feast next evening, the lad being gaily painted and the centre of attraction at the accompanying dance. The skull of the turtle or lower jaw of the dugong is painted by the initiate, and it is then secreted in a hole or crevice at the back of a rock-shelter, where it rests in company with numerous similar records.

Fig. 51 depicts the turtle skull decorated by Wondal (the last of the Stanley Island males) when he was an initiate. It was shown to the writers when examining a large shelter at Endaen, and was preserved in a narrow crevice. It was associated with nine other painted turtle skulls and seven dugong lower jaws, all of which were brought out and displayed for the purpose of a photograph.

Fig. 52-53 represent older skulls, the colour patterns of which were revived by Wondal; fig. 54 shows an ancient example preserved in its natural state.

CEREMONIAL LIFE.

Reference is made above to the hunting feast which is held when a youth kills his first turtle, and various other phases of ceremonial life are described under the heading of trading customs, and death and burial rituals. It is here possible to record only a few ceremonials and dances of the less serious type. These performances, however, play an extraordinarily important part in the everyday life of the natives, their frequence being an index of the physical and mental well-being of the community.

The advent of the pearling and trepang fisheries on the Great Barrier Reef, and the consequent employment of the majority of the younger men as divers and hands on the boats, struck a deep blow at the whole social fabric of the coastal natives. The older people, deprived of their food-gatherers, and ravaged by introduced epidemic diseases, are dying out rapidly, while the prolonged absences of the potential fathers of the coming generation has no doubt assisted in reducing the birth rate almost to vanishing point. Under such conditions the intensity of their ceremonial life has naturally greatly diminished, and many of the more important phases will shortly entirely disappear.

In good seasons, when food is abundant, dances are held almost nightly, in a cleared space within the precincts of the camp. At Apa, on Flinders Island, this dancing area was so situated (fig. 57) that the wet-season huts of the various families were placed around it, each group on the side nearest to its home country.

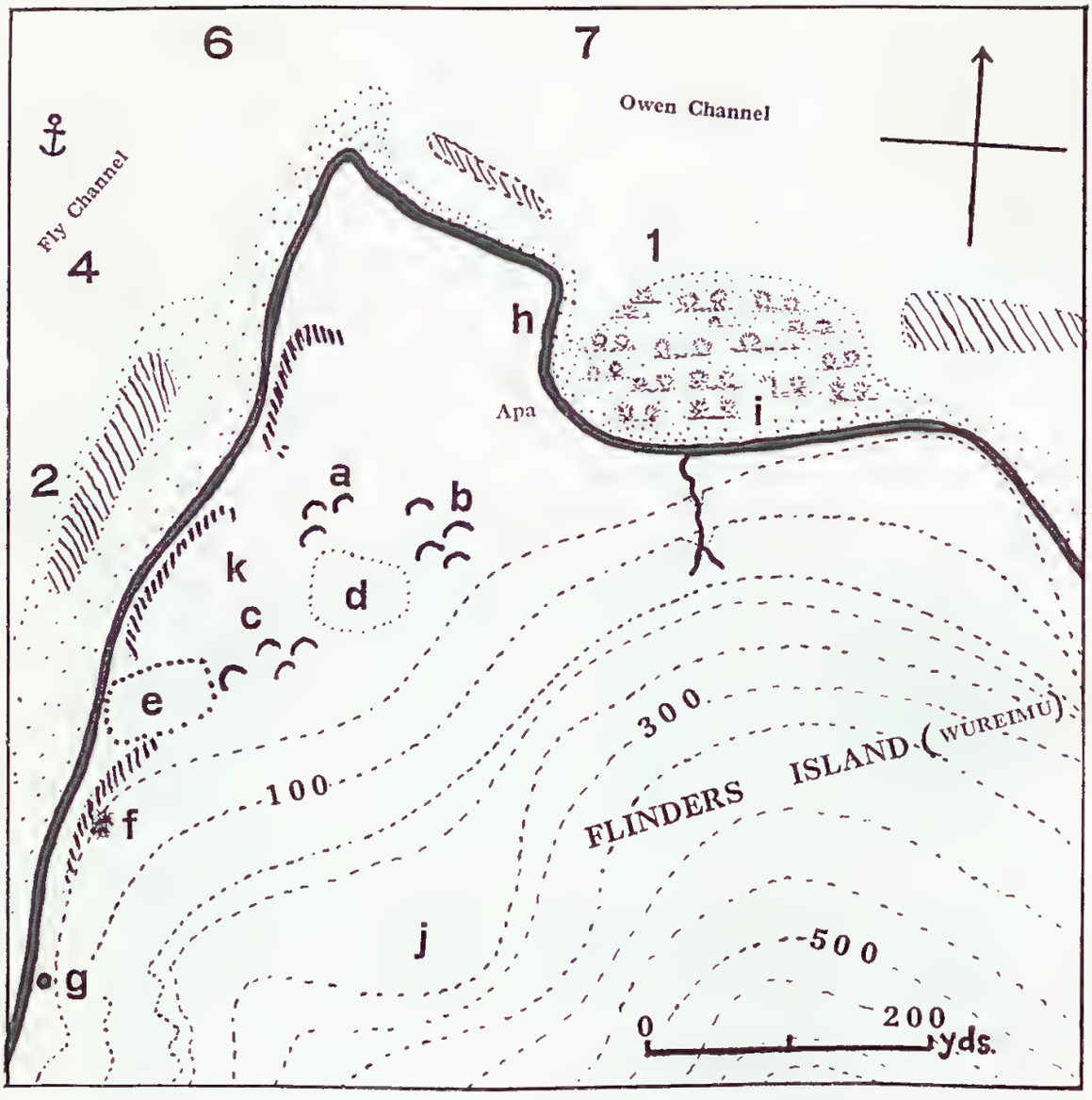


Fig. 57. Plan of native camp at Apa, Flinders Island, during north-west monsoon season, January, 1927. a, Camp of Stanley Island natives. b, Flinders and Bathurst Head camps. c, Kokolamalama camps. d, Dancing ground. e, Area where ceremonial receptions of visitors were held. f, Pile of dugong bones. g, Native well, sole water supply on island. h, Canoe beach. i, Apa mangrove swamp. j, Small area with wild yams. k, Camp of Museum expedition. (Depths in fathoms; contours at 50 foot intervals).

On one occasion when such a dance was held each man was decorated as follows: The hair was combed out into a mop and dusted with pipeclay. White rings were painted around each eye, so that they joined upon the nose, and a white streak ran across his forehead. The side of the neck and the arms were decorated with vertical stripes, there was a white ring around the shoulders, two broad stripes crossed the chest obliquely, and three bands of the same colour were painted around each leg.

The women had their limbs decorated in a similar manner, but their faces were marked in one of two ways. In the front there was a forehead band and a broad spot of white on each cheek; in the other a pyriform design was formed by a stripe passing down between the eyes and nose, across the cheeks, to meet its fellow on the chin. An oblique forehead stripe completed the design.

The old men sat in a group and sang in high-pitched voices. Several of them accompanied the singing by beating pairs of tapping-sticks; the women sat together in a group at the opposite end of the cleared space, and also beat time by striking their cupped hands against the upper and inner parts of their thighs. From time to time one of them rose and placed branches of trees and bundles of grass upon the fire to provide added illumination to the scene.

Seagull Dance.

The 'arwora,' or seagull dance of Ngoromo (Clack Island) was performed. The refrain of this dance was as follows:

"Wongal nganjai unbarworoloi"; repeat.

The performers were placed in three semicircular lines, with the concave side facing the old men. The two front rows consisted of men, the hindermost of women. The men stood with arms and legs outstretched and rigid, and took three shuffling hops, first to the right and then back to the left, bending their bodies somewhat in the direction of progress. At the commencement of the dance the men simultaneously uttered a series of loud exclamations—'Tjer! Tjer!'—after which they continued to grunt loudly throughout the performance, which continued, with pauses for breath, for about half an hour. The women performers stood upright in the background, with their feet close together, and shuffled sideways by moving alternately on their heels and then on their toes. At first their progress was towards the left, but when the men changed direction they returned towards the right.

Ancestral and Other Dances.

Another dance described the way in which ancestral beings cleared a track through a big scrub or jungle on the mainland. The "track" appears to be similar to those periodically cut through the forests of North Queensland by cyclones.

The older men sang: "Alngerunga mangar maurali mangala mangala."

The men knelt down in a long line in the foreground, while the women performed the same evolution as in the preceding dance, grunting loudly all the time. The kneeling performers swept the ground before them with twigs held in

the right hand, swaying from side to side, twitching their bodies, and grunting as they did so.

No name was given to the following dance, in which the men stood in a line and stamped vigorously; their legs were wide apart, and they held leafy twigs in their hands, which they first displayed high above their heads, and then suddenly with a jerking movement withdrew behind their backs, only to raise them again equally suddenly a few moments later. These alternating movements were kept up for nearly an hour, during which the women shuffled as before, in the background. The old men sang the following song:

"Ae mangala mangala a a la la mangala mangala"; repeat.

At the conclusion of this performance the men simultaneously gave an unusually loud grunt as they raised their right hands above the head and another as they jerked them suddenly down.

In another dance (vaguely described as being the attempts of two ancestral beings to cohabit) two men stood back to back, with their legs apart and their hands linked together. They stamped on the ground, making a show of great effort as they lifted their feet and brought them down. The right foot of the one performer and the left foot of the other were lifted simultaneously. The women continued their usual shuffling dance and their grunting, while the old men sang the same song as in the previous dance.

Closely following on this dance was one in which both sexes performed like movements. The performers took their places in two semi-circles, as in the Arwora dance, the men in front, the women behind. Holding a leafy bunch rigidly before himself with outstretched arms, each performer moved sideways with the shuffle practised by the women in previous dances. A slight variation in the method of movement enabled each performer to gradually move forward towards the centre (instead of sideways), so that the whole troupe of dancers eventually came together in a closely-packed bunch. They then worked gradually backwards until they reached their former positions. The "Ae mangala mangala" song was sung throughout this dance, and the intensification of excitement throughout it was indicated by the vigour of the grunting and the strenuous, though restrained, movements of the performers. The dance was continued for perhaps half an hour, and was concluded with two very loud grunts, as before.

This performance was the climax of the evening, and at a signal from the old men the proceedings concluded, it being then midnight. An occasional sound of excited laughter and brief snatches of various songs drifted over from the different camp-fires for an hour or more before silence prevailed.

Women's Dances.

Some Walmbaria tribe dances are performed largely by women, the men being present chiefly as spectators or as singers and time-beaters.

The women are decorated with pipe-clay (from a deposit on the south side of Flinders Island) or, more rarely, with yellow ochre. Usually a broad white band is painted across the forehead, and a line runs down the middle of the nose; one young unmarried girl had broad white marks painted on each temple, but was not otherwise ornamented. The bodies are marked with broad transverse bands of pipe-clay, which are not continued on the back.

In one such dance observed by us several men kept time by clapping hands, another beat time on a paper-bark bundle or cushion taken from a canoe, while yet another struck a metal tin obtained from our camp. One man sang the whole time the familiar, but apparently now largely meaningless, word recorded above ('Ae mangala,' etc.). The others joined in at intervals to relieve or assist him.

In the first dance the women took their positions in two transverse lines facing the men, who were grouped together at the northern end of the dancing-ground, and shuffled sideways in the usual manner, putting great efforts into the dance and grunting loudly.

This preliminary movement was followed immediately by the 'Topanpo,' or cassowary dance, in which a spear was driven upright into the ground, and the women performers grouped themselves around it in a half-circle at a distance of perhaps five yards. One man took part in this dance. He took his position at the right end of the semi-circle, but only a couple of yards from the spear, and moved counter clock-wise in a circle. The women also moved very slowly in a counter clock-wise direction as the dance proceeded, and slowly closed in on the man, so that eventually all were crowded closely together against the spear. Each performer danced in a crouched position, with the right hand raised up to simulate a bird's head, and the left raised to the shoulder.

In a second movement of this dance the spear was removed, and the man stood upright in its place, with feet widely apart, and holding bunches of leaves in his hands, which were held apart at arm's length. The man's part in the previous dance was now taken by a small boy of some eleven years, who imitated the man's actions of the cassowary throughout. Each dance took only about one minute to perform, after which there was a pause of from ten to thirty seconds, during which the performers returned to their former positions. After perhaps fifteen minutes the first movement was replaced by the second, which continued for a similar period. Excitement became intensified as the performers reached the climax of the dance, after which they hurriedly departed for their respective camp-fires.

PERSONAL NAMES.

No restrictions are placed on the use of personal names, but in ordinary conversation kinship terms are frequently employed in referring to individuals and in addressing them individually. Nicknames are not common, but a person may bear three or even more names. Two or more closely related adults may have the same individual name, and this tends to prove perplexing at first; as examples it may be mentioned that two Mutumui half-sisters by the same mother (the fathers were brothers) bear the name Atenmale, and that two Walmbaria full-brothers bear the name Wondal.

Frequently a son is given the name of a father or father's father, and a daughter may be named after its father's sister. Others are named after localities, e.g., Wondal is a mountain peak on Bathurst Head, and Ekanjin (a woman's name) is a place name in the same district. Endaen is the name of the principal cave of the Stanley Island aborigines, as well as the name of a father and son belonging to that place.

Two Barunguan girls, about ten and twelve years of age, were both known by their mother's name, Opoja or Opoji. They had a young married sister, previously also known as Opoja, who had been given a further name (Motjutowa) just before marriage. This custom of naming a girl after its mother is in marked contrast to that of the Luritja tribe of Central Australia, among whom it is the gravest of all insults to call a person either by his mother's or his father's name.

Children are frequently without names. Two Mutumui children at Flinders Island (a boy and a girl aged about six and nine) were nameless at the time of our visit. Our interested enquiries led the mother to send a message stick (with a verbal message) to the father, who was absent on the mainland. His reply was received about a month later, and the names of his choosing were immediately adopted. In another case the father's brother bestowed the name borne by a boy.

MAGIC.

The writers were anxious to secure as many hair samples as possible, but were successful in only a score of cases. The Walmbaria and Barunguan people are averse to allowing another to obtain portion of their hair, believing that the possession of this gives an enemy the power to "wish" harm, or even death, to the man from whom it was taken, a belief which, in various forms, is world-wide. In all the Princess Charlotte Bay tribes, when a man trims his hair he is careful, therefore, that no one shall pick it up with nefarious purpose, and if near the coast may even go on to a reef, so that the cuttings will be carried away on the tide.

The Walmbaria people believe that, in certain circumstances, the death of a man may be brought about by the painting of magical figures. If a man steals a woman, and escapes with her to the mainland, the old men visit Clack Island and paint the figure of a man on the rocks; the seducer soon sickens, and eventually dies.

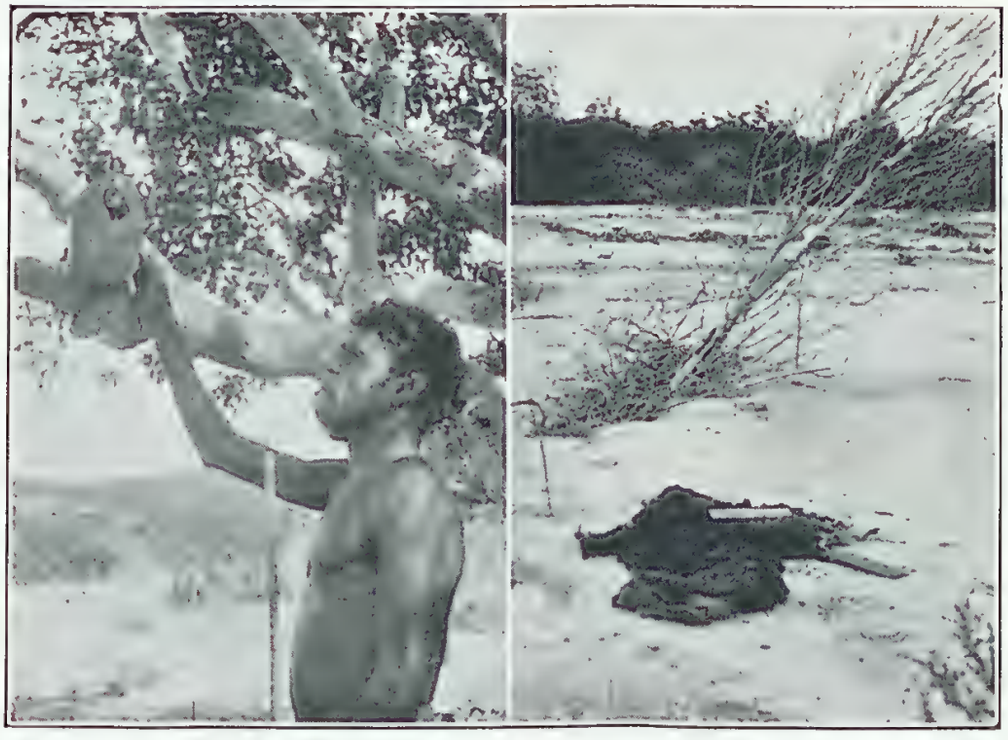


Fig. 58. Turtle increase charm; Walmbaria tribe, Bathurst Head.

Fig. 59. Discarded belongings of dead girl; Walmbaria tribe, Bathurst Head.

Some old beliefs are carried down in the form of legends; apparently some of the stories have been originated to explain natural features of their country. For instance, Blackwood Island ('Wakayi'), when viewed from Bathurst Head, resembles a recumbent man; from this circumstance has arisen the story of a bygone warrior who was buried there on his back.

When the Flinders Islanders intend to visit the mainland the old men, by lighting a fire and "singing," can make fine winds come, and thus ensure a safe passage for their canoes. The latter are then paddled along the coast to near Tilpanga (fig. 2), where a pointed cylindrical stone projects above a pile of rocks. This is said to have been erected long ago, and marks the spot from which canoes must leave the island (fig. 61).

The women, when searching for food, sing in order that abundant supplies shall be forthcoming. The free translation of the song of a girl looking for oysters on a reef at Bathurst Head is as follows: After finding an oyster she sang,

"I have one, why have I not two?" ("I find him one, why no more I find him two?"); finding a second one, she said, "I have two, why have I not three?"; this was repeated until a third was found. Apparently after the fourth oyster was discovered the song began afresh.

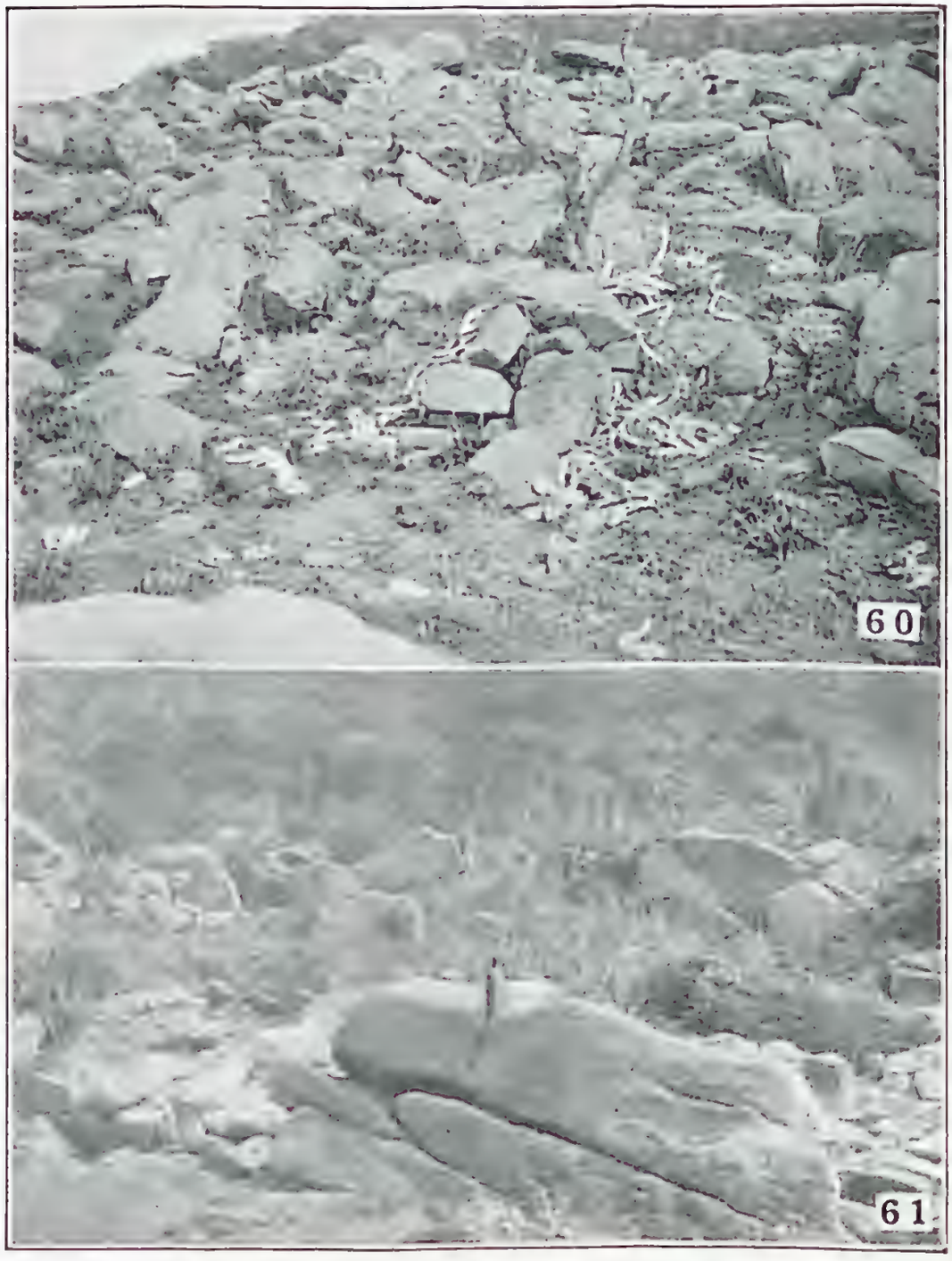


Fig. 60. Dugong increase charm; Walmbaria tribe, Flinders Island.
Fig. 61. Cylindrical stone marking point from which canoes must leave Flinders Island.

Of similar import was the Walmbaria injunction sung to the piece of yam vine thrown back into the hole after recovery of the yam: "Go back, make a big one."

Magical objects are sometimes associated with invocations. When the water-holes are drying, and the men are "singing" rain, additional assistance is afforded by hanging "rain-makers" in the trees. These consist of flat rectangular pieces of wood, painted with red ochre and pipe-clay, which are slung by a length of *Livistona*-fibre twine, so that they will twist about in the breeze. (Fig. 55-56.) When these objects rotate in the wind, rain is sure to come within a short time.

If a good catch of turtles is made in a particular locality the Walmbaria people paint the heads of their captures and place them in trees in the vicinity to ensure further good supplies (fig. 58). Captain Phillip P. King (7), when visiting the Flinders Islands in 1819, remarked on turtle heads treated in this way. He stated: "On the branch of a tree near at hand were three turtles' heads; and since they had been placed there the young branches had expanded, causing us to wonder at first how the heads could have passed over them . . . we have since frequently noticed the same thing, which could only have been left by the natives."

For the same reason the Walmbaria natives collect the bones of dugongs after feasting (fig. 60) and pile them together. We saw many of these heaps, of various sizes, both on the islands and on the mainland of Princess Charlotte Bay; some included the bones of only one or two animals, but one we examined near a camp at Bathurst Head was six feet in length, three feet in width, and about three feet in height. All the major bones of the mammals were present, but dogs had chewed away all the thinner portions of the skulls.

DREAMS.

Some little difficulty was experienced in explaining to the Walmbaria and Mutumui natives just what we meant by "dreaming," but once they comprehended information was forthcoming. The natives often dream, and the following experiences are typical.

One man several times dreamt that he saw dead people, or a dead person, come out of the ground and walk about; on these occasions he tried to run, but his knees doubled up, and he could only crawl very, very slowly.

A man sleeping with a friend during a hunting expedition dreamt that he was dead; he awoke and told his companion, and they both laughed. Others dream that they are chased by big, savage fellows, and that they cannot run away,

(7) King, Survey Coasts Aust., i, 1927, p. 231.

because their legs refuse office; they commonly dream of everyday occurrences, hunting dugong, turtle, etc., of wallabies in the rocks and kangaroos in the scrub.

The natives are afraid of the dark, and the women in particular hesitate to make even short journeys away from the light of the camp-fires.

DEATH, MOURNING, AND BURIAL.

Death among the Walmbaria natives is not attributed to natural causes, but to magic, and in earlier times, before native troopers and white men had broken down some of the old customs, tribal fights succeeded the decease of a man. Some time after the funeral ceremonies (apparently about two months after) the Walmbaria people sallied forth and attacked one of the neighbouring tribes. They fought on open, sandy beaches for preference; spears were used, and sometimes the combat lasted all night, considerable damage being inflicted. The Bathurst Head and Flinders Islands groups of the tribe often combined with the Kokolamalama to attack the natives of Barrow Point, Cape Melville, Cape Boyne, Starke River, and Mack River. At times, however, the Flinders Islands people became unfriendly with the Jane Table Hill people, and fights took place between them. Some of the older men point with pride to the scars left by stingray spears as a result of these combats.

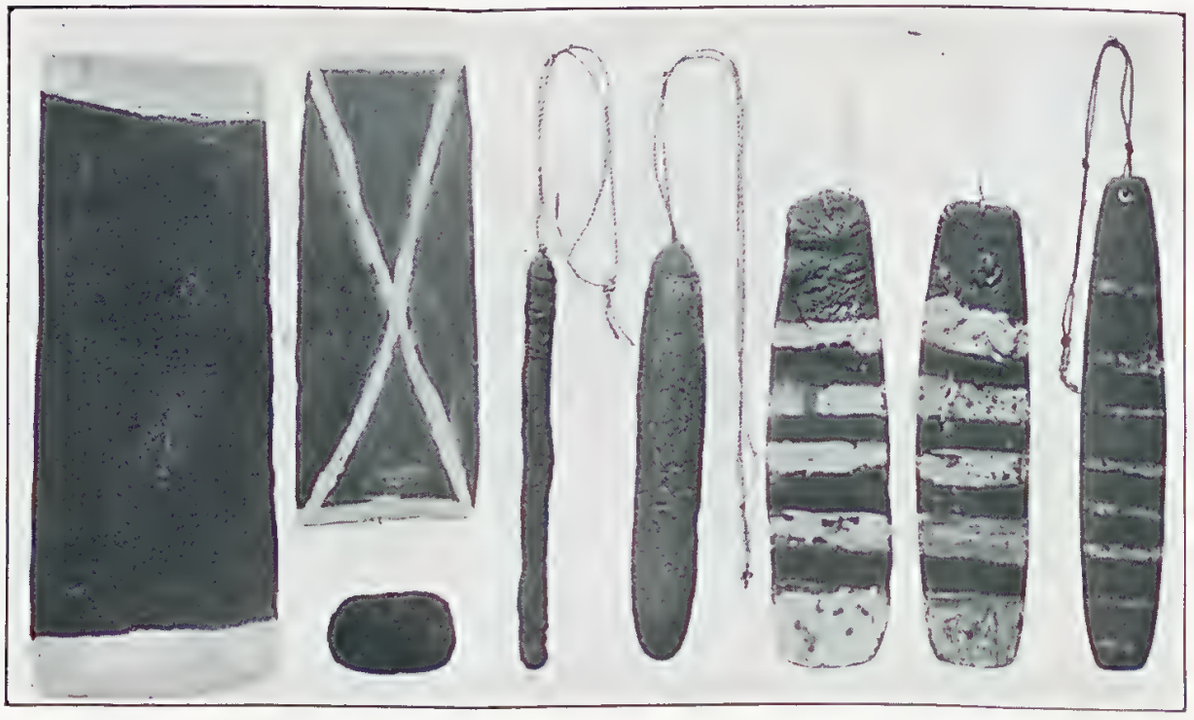


Fig. 62–63 and 67–69. Wooden mourning tablets; (62–63, Walmbaria tribe, Bathurst Head; 67–68, Walmbaria tribe, Flinders Island, fashioned from spear smoothers of the deceased; 69, Barunguan tribe, Pt. Stewart). Fig. 64–66. Mourning pendants of human hair; (64, Walmbaria tribe, Bathurst Head; 65–66, Barunguan tribe, Pt. Stewart).

When a man dies the body is wrapped in bark; a mourning ceremony is performed, at which there is much ritual, wailing, and cutting of the body with shells, and the corpse is then buried. Usually the bones are disinterred later, wrapped in painted bark, and the bundle is placed in a tree. Sometimes a long period elapses before this happens, sometimes only a few days, and in a few cases the buried body is left undisturbed.

Fig. 70. Barunguan man with mourning strings; Stewart River.

Fig. 71. Barunguan man with mourning pendant of hair covered with beeswax; Stewart River.

Some special objects are used at the burial and during mourning, and special customs are observed. Rectangular tablets, known as 'opamaka' (fig. 62-63), painted with red ochre and white pipe-clay, are placed in branches of trees at the place of the ceremony. These are usually made by the men, and vary in number according to the importance of the deceased; in some cases they are fashioned from the spear-smoothers of a dead man (fig. 67-68). The hair of the corpse is cut off, and bound over with *Livistona* twine to form sausage-shaped or cylindrical bundles (fig. 64-65), which are hung around the necks of mourners as a sign of grief; often these pendants are covered with beeswax so as to wholly conceal the underlying hair and string (fig. 66, 71). If available, a ceremonial net dress ('iyawur') and cap ('akwama'), made from fishing nets used by the deceased are worn, the relatives taking turns in the wearing of this costume

during the wailing, crying, and dancing. The dresses and caps appear to be rare, but we were able to secure two ancient examples (fig. 73). Painted wooden staves (fig. 74-75) or "wailing-sticks," five to seven feet in length, and with a lump of gum at one end, are used at the ceremony and elsewhere, and afterwards are placed on the temporary grave of the departed, whose possessions are hung upon them; in some cases two such sticks are held, perpendicularly, one in each

Fig. 72. Demonstrations of Walmbaria method of lashing a corpse to a pole for burial.

Fig. 73. Mourning apparel made from fishing nets of deceased, Flinders Island.

hand, by a relative during wailing. If a good hunter dies the young men sometimes cut out the ulna from both arms, and the bones are afterwards used for making the heads of turtle spears. During the mourning period following the burial a widow plasters herself with mud, both head and body, and may also wear a painted wooden pendant around the neck, plaited strings wound around the arms and sometimes round the neck also. When these strings are removed from the necks of women they are rewound and worn by male mourners; in the latter case the loop of the chain-strings is passed over the head and under one arm, so that it extends diagonally across the chest and back; generally two sets of strings are thus worn, as shown in fig. 70. Hair pendants are also worn by mourning relatives, who do not trim their hair for months, and, in the case of men, allow the beard to grow unchecked.

The following is a description of a grave which we opened at Bathurst Head for the purpose of securing the skeleton of Wapinarinji, one of the Walmbaria natives. A semicircular hut of sticks and bark, about seven feet in diameter, and similar to those used in temporary beach camps, had been erected over the grave, which was situated among grass-grown sandhills near the beach. The body was tied to a stake in a crouched, sitting position, with the head fallen forward; in this posture it had been wrapped in a bark package and buried in the semi-erect attitude. There was a large sheet of bark over the head, which was no more than two feet below the surface of the ground. Ennan, son of Wapinarinji, posed, as shown in fig. 72, in the approximate position in which his father had been interred.

Fig. 74–75. Mourning staves; Walmbaria tribe, Flinders Island. Fig. 76. Dugong harpoon head; Mutumui tribe, Barrow Point. Fig. 17. Woman's digging stick; Barunguan tribe, Pt. Stewart. Fig. 78–79. Canes prepared for honey collecting; Barunguan tribe, Pt. Stewart. Fig. 80-81. Firesticks with decorated sheaths; Barunguan tribe, Pt. Stewart.

In olden times the dead were sometimes buried in the extended position, flat on the back; others in the squatting posture, lashed to a stake. Sometimes, especially in the latter method, the face was turned up to the sky, but in other cases the head was allowed to fall forward.

At Walaeimini, on Bathurst Head, we accidentally noticed a heap of discarded native materials beside the ruins of a temporary hut at a place where a

mourning ceremony for a young girl (Yerkungar, emu totem, of Flinders Island) had been held (fig. 59). The objects, which were in a perished condition, consisted of dilly-bags, a small pubic tassel, wooden tablets ('opamaka') similar to those already referred to, and a mourning pendant of human hair hung on a forked stick. This girl, we were informed, had plenty of hair, enough to make many mourning pendants, one of which had been discarded by a passing relative, who had considered his mourning complete. A ball of human hair was also present, but this had belonged to a man who had died at about the same time.

At Stewart River the mourning tablets are more elongate (fig. 69), but the burial and mourning customs of the Barunguan tribe are apparently similar in many respects to those of the Walmbaria. The body is buried for a variable period, exhumed, and the flesh then picked off the bones, which are carried about for as long as two years; there is then a big ceremony, at which the person accused of causing the death is punished. The bones are transported to and finally buried at, the birthplace of the deceased; mourners, who have been wearing their hair long, trim it after this "finish-up" ceremony. The Barunguan people also use the painted wailing-sticks. A Barunguan woman having died, the husband obtained one of the objects. He held the stick horizontally between his upraised hands, and at intervals bent his body and arms to the ground, wailing loudly the while, continuing these actions for several hours. When a strange native dies at Stewart River, or in the neighbourhood, the Barunguan people bury him in a sand-bank in the bed of the river, in the hope that the next flood will wash his bones away; then his spirit will not walk about unhappy in a strange place and trouble the Barunguan people.

FIGHTING AND WEAPONS.

It has already been mentioned that tribal fights at one time followed a death. Although these were more or less in the nature of ceremonial affrays, they often developed into serious battles. When the Bathurst Head people anticipated hostilities they kept watch at Meltjelin, on Bathurst Head, from which place they could see eastward along the coast. When their enemies appeared they prepared for battle by freshly painting their spears and hastily splashing white paint over their bodies, so as to make an impressive show (fig. 82).

The spear is the usual weapon of combat, and men's fighting spears, like most other kinds, are almost always thrown with the aid of the throwing-stick.

The writers witnessed a ceremonial fight on Flinders Island. One afternoon a small party of Kokolamalama natives from the mainland reached the island. The Barunguan wife, Mini, of Awudu (Walmbaria tribe) was in the Flinders

Island camp with her husband; she had been previously speared in the shoulder by one of the new arrivals, and this was a rankling grievance. The men arranged themselves into two parties, each man carrying spears and spear-thrower. They fitted their spears into their spear-throwers, and made passes as they walked towards each other, lowering their weapons when within striking distance; the

Fig. 82. Method of holding spear and spear-thrower; Walmbaria tribe, Flinders Island.

walk was a half shuffle, in which dust was kicked up in a cloud. The woman Mini also carried a spear, which she brandished; after a great deal of talk she retreated some distance, and pretended to throw the spear at the mainland party. During this affair the men shouted at each other in high-pitched voices, and others sang a song, while women who were not directly concerned talked excitedly. Several men took no interest whatever in the happening, which was apparently in the nature of a threat to the delinquent.

The method of holding the spear and spear-thrower (fig. 82) is very similar to that illustrated by one of the writers in a previous paper dealing with Groote Eylandt natives (8). The spear-throwers are cut from hardwood trees (fig. 84), and are flat and usually rather wide; a hardwood peg (with a nick to receive the slightly hollowed end of the butt of the spear) is fastened against one end with gum and twine, while at the opposite end is a rather large baler shell ornament, the making of which occupies considerable time. Two pieces of shell are roughly chipped to shape (fig. 90), and are then ground to an oval form on stones, sand and water assisting the operation (fig. 91-93); next the convex outer face is polished on a smooth rock (fig. 83), using finer sand as an abrasive, until it is pure white. The shells are then placed, one on each side and with the concave or inside faces opposed, at the "grip" end of the throwing-stick, and fastened with beeswax, which fills the gap between them. A charm is frequently concealed

(8) Tindale, N. B., Rec. S. Aust. Mus., iii, 1926, p. 134, fig. 65.

within the adhesive between the two shells. The thin "grip" portion near the shell ornament is coated with bloodwood gum, and sometimes also bound with string. The shell ornament may also be bound across with wallaby or kangaroo sinews (fig. 95, 97). During combat the spear-thrower is used to divert, or parry thrown spears, the flat of the implement guiding the spear to one side or over the shoulder.

Fig. 83. Grinding baler shell ornament for spear-thrower; Walmbaria tribe, Flinders Island.

Fig. 84. Felled tree, with spear-throwers in the making; Walmbaria tribe, Bathurst Head.

This type of spear-thrower (fig. 86) is made by all the Princess Charlotte Bay tribes; those used at Jane Table Hill by the Kokolamalama (fig. 87) are more slender than those of the Walmbaria tribe (fig. 88). Some of the spear-throwers of the coastal tribe near Cairns are similar (fig. 89), but lack the baler shell ornament and the gum and lashing at the grip end: these people, however, use shields. The Princess Charlotte Bay people depend only on their throwing-sticks to protect themselves from spears, and the baler shell ornament is said to prevent it from slipping out of the hand when thus used.

The area within which these baler shell spear-thrower ornaments are made is

limited to Cape York, but the shell discs detached from the throwers are articles of trade to southern inland peoples. By slow degrees they may pass south-east as far as Cooper Creek in South Australia, where they are highly prized as neck ornaments to be worn by young male initiates. The Yendruwunta of Cooper Creek have no knowledge of their origin, save that they come from the north.

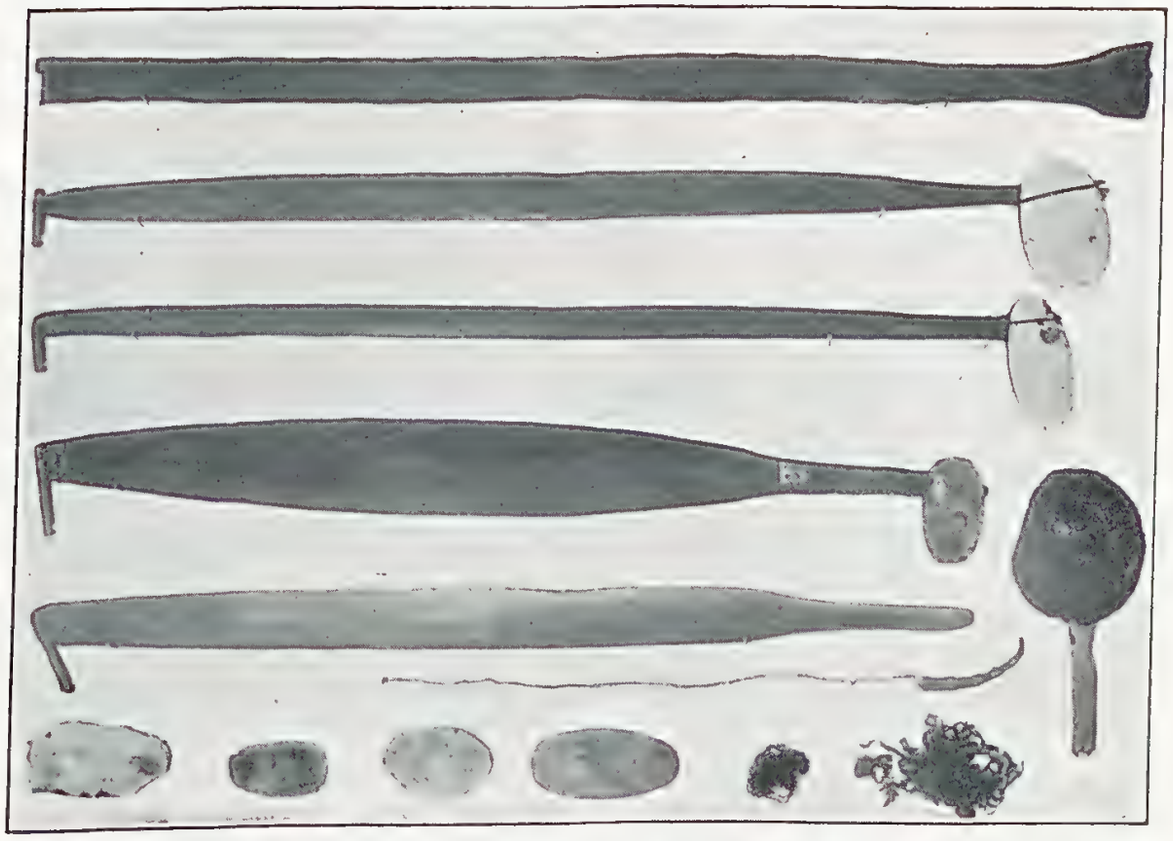


Fig. 85. Throwing stick in the course of manufacture; Walmbaria tribe, Bathurst Head. Fig. 86–89. Types of throwing sticks; (86, Barunguan tribe, Pt. Stewart; 87, Kokolamalama tribe, Jane Table Hill; 88, Walmbaria tribe, Stanley Island; 89, Hileman tribe, Mona-mona, Atherton). Fig. 90–93. Stages in making of baler-shell ornament for throwing stick, Walmbaria tribe, Flinders Island. Fig. 94. Eucalyptus gum for hafting spears; Barunguan tribe, Pt. Stewart. Fig. 95. Sinews as drawn out from tail of Agile Wallaby, tail tip attached; Barunguan tribe, Pt. Stewart. Fig. 96. Wallaby sinews prepared for use; Barunguan tribe, Pt. Stewart. Fig. 97. Sinews of large grey kangaroo; Walmbaria tribe, Bathurst Head.

Spears with a bamboo shaft and a plain hardwood point were used at the ceremonial fight noted above, but spears barbed or tipped with the spines of stingrays and of the stone fish (*Synanceja*) are the real fighting weapons of the Walmbaria, Mutumui, and Barunguan. The authors obtained a couple of dozen of these spears, which show some variation in the arrangement of the stingray spines. In one Barunguan type a single large spine forms the point of the spear (fig. 98); it has a spine fastened into a piece of palmwood twenty inches in

length, which is itself joined to a five-foot hardwood shaft, to the base of which is spliced a further two-foot length of light, soft wood, forming the butt. Additions of this sort (due either to the weapons having been damaged or to the desire to have the head of the spear heavier than the shaft) are quite common, and represent a distinct advance upon the single-piece spears met with further south. Fig. 99-103 show spears with a cluster of small stingray spines at the apex, lashed on in groups with wallaby sinews. In another type (fig. 104-106) small spines are tied on to a palmwood head so as to form barbs; often a dozen or more spines are thus arranged.

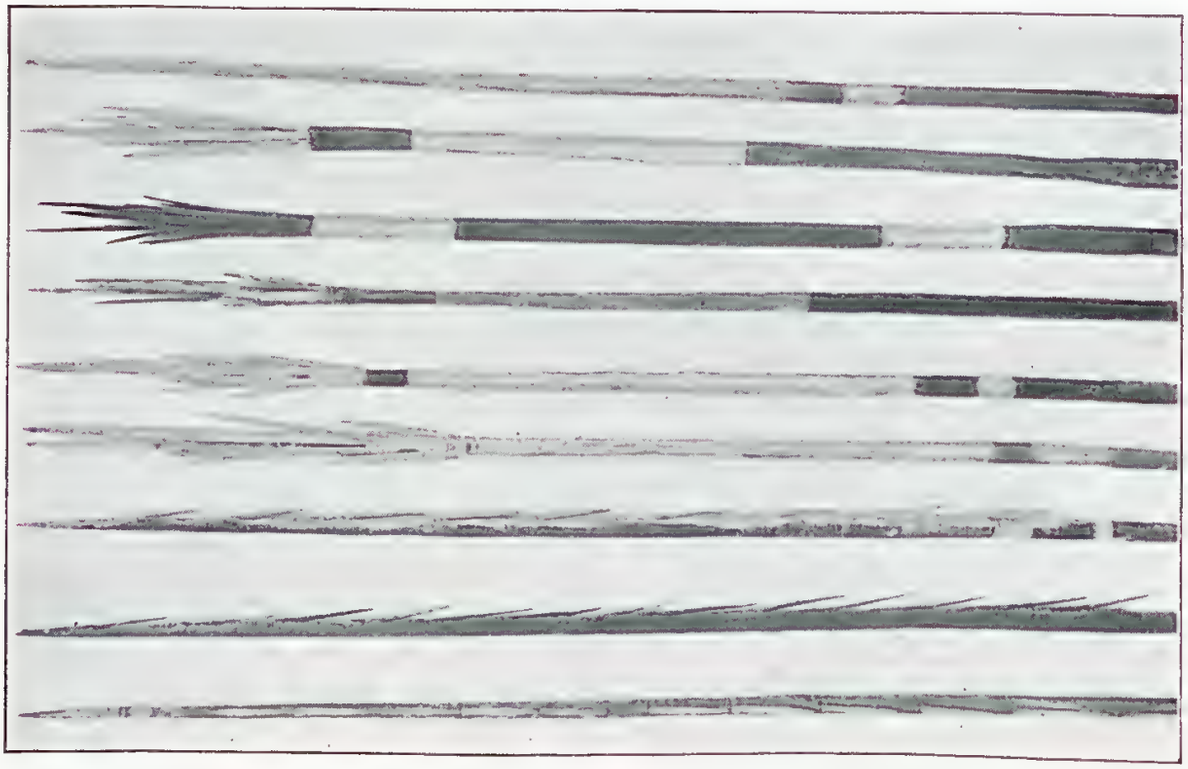


Fig. 98–106. Stingray spear heads from Princess Charlotte Bay (98, Tipped with a single spine; Barunguan tribe, Pt. Stewart, 99–103, Tipped with a cluster of small spines; Barunguan tribe, Port Stewart–99–101; Mutumui tribe, Cape Melville–102–; and Walmbaria tribe, Stanley Island–103–104–106, With a series of spines arranged as barbs; Barunguan tribe, Pt. Stewart –104–105–; and Walmbaria tribe, Flinders Island–106–).

Fighting spears are always painted with red ochre and white pipe-clay, the spines being coloured as well as the head and butt. The Walmbaria people sometimes anoint the barbs with a vegetable poison obtained on the mainland, and say that a man dies quickly when wounded by them; a native who gave us two prized spears made at Bathurst Head warned us that the spines were thus poisoned. One of the very few other records of poisoned weapons amongst Australian abor-

igines is that furnished by Chatfield (9), who, writing of the Natal Downs (Queensland) natives, states that unbarbed spears of these people "are covered with the gum of the gidyah-tree, which is supposed to aggravate the wound."

Fig. 107–108. Butt (top) and head portions of woman's fighting spears; Banunguan tribe, Pt. Stewart. Fig. 109–110, Hardwood heads of small hunting spears used by women and children; Barunguan tribe, Pt. Stewart. Fig. 111–112. Three and four pronged fishing spears; Barunguan tribe, Pt. Stewart. Fig. 113. Four pronged fishing spear, Mutumui tribe, Barrow Point.

Two women sometimes settle a quarrel by actual fighting. Their weapons are either heavy yam sticks (with which severe scalp wounds are inflicted) or hardwood javelins made in one piece, and used for women's fights only. When using the spears the women stand a short distance apart, and jab at each other with the pointed ends. Two of these women's fighting javelins are shown (fig. 107-108). They are much thicker and heavier than the other types, one of those illustrated weighing 52 ounces, the other 40 ounces. They are decorated with bands of red ochre, which in the photograph are scarcely visible on the red hardwood. Almost all other types of spears are made in from two to four pieces, a shaft of bamboo, softwood, or hardwood, and a hardwood head, which is usually about one-fourth as long as the shaft. Sometimes a spear is made from a single piece of hardwood ten feet or so in length, and a short basal part of bamboo only about a foot in length; in this type the hardwood is shaped so that the head is thicker and heavier than the basal half. The gum chiefly used for joining or morticing lengths of wood to form the shaft, and for fastening the head to the

(9) Chatfield, in Curr, The Australian Race, ii, 1866, p. 473.

shaft is the exudate of the bloodwood (*Eucalyptus*), which the Walmbaria people call 'otara'; it is obtained from the mainland, the main supply (fig. 94) being secured through trade from Starke River, where the tree is common. The joint is bound with twine or sinews, and is smoothed with a flat piece of wood fig. 114-121), shaped for the purpose and hafted with gum. A perfectly finished splice exhibits a shellac-like gloss of glassy smoothness. During the work a man dexterously rotates the spear with one hand, at the same time applying the

Fig. 114–121. Spear smoothers; the example shown in fig. 120 is also a graver (114, 119, and 120, Barunguan tribe, Pt. Stewart; 115–115, Walmbaria tribe, Flinders Island; 117, 118, and 121, Mutumui tribe, Barrow Point, and 118 only, Cape Melville).

splice to the flat of the smoother (which is held in the other hand) with considerable force; occasionally a hand is drawn across the forehead to collect sweat and grease, which is applied to the splice, and assists in obtaining the desired result. One of the spear-smoothers illustrated has a small spike at one end; to this projection the incisor tooth of a wallaby is fixed, to be used as a graver, scraper, or cutter (fig. 120). Two of the smoothers shown (fig. 118 and 121) differ in having the end opposite the gummed portion not thin-edged or pointed, but thick and plentifully smeared with gum. The end of this type is used to press melted gum into or against a splice.

A form of scraper or chisel commonly used in the manufacture of spears and throwing-sticks by the Barunguan natives, and less commonly by the Walmbaria,

consists simply of one of the lower jaws of an agile wallaby (fig. 122-123). From time to time the tooth is broken across between the teeth of the operator, so that it presents a fresh cutting edge of enamel.

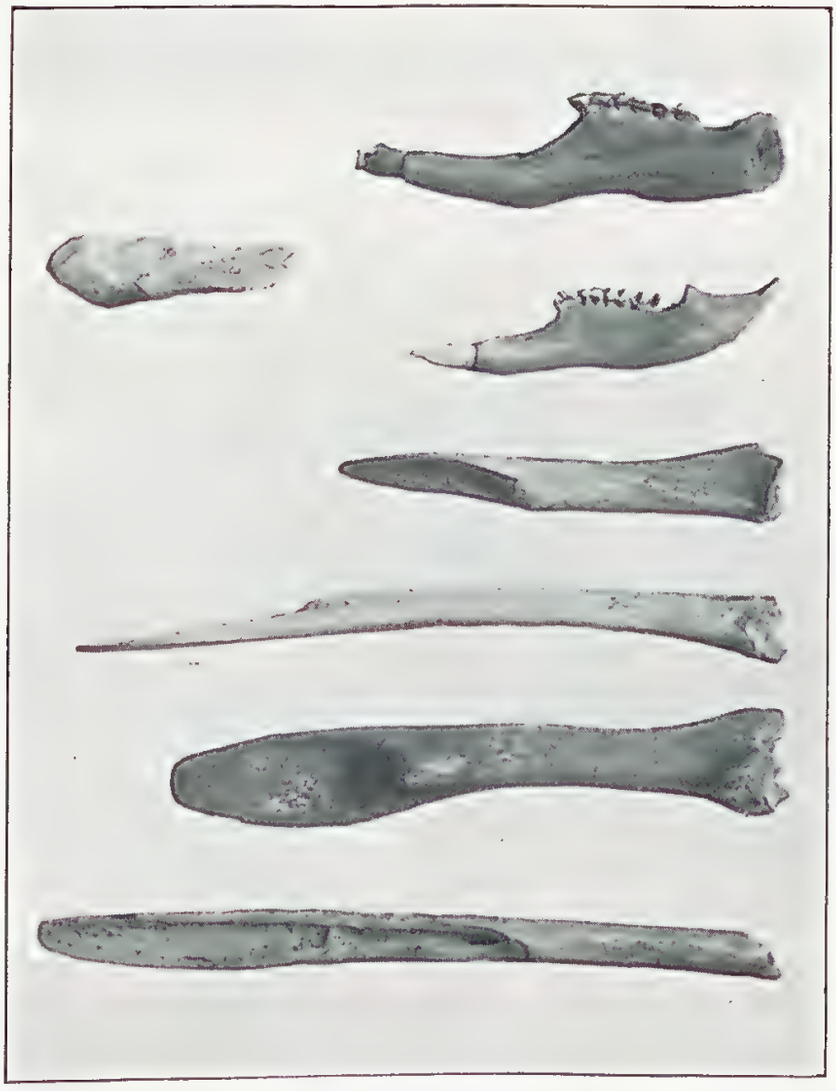


Fig. 122–123. Agile Wallaby jaw as graver; Barunguan tribe, Pt. Stewart.

Fig. 124–127. Gouges fashioned from leg bones of birds; Barunguan tribe, Pt. Stewart.
Fig. 128. Implement of human bone used for stripping *Pandanus* fibre; Walmbaria tribe, Bathurst Head.

Both for trade purposes and for convenient use gum is often melted into thick "pancakes" around a short piece of wood, leaving one half of the latter projecting as a handle (fig. 94).

Wooden spear-heads are sometimes anointed with an oily substance, which is obtained by heating a kind of candlenut (*Aleurites moluccana*), called 'tor-torwul' by the Walmbaria, which drifts into the coast from the north or north-

east; this fluid "fixes" the pigments with which the spears are ornamented. The men's hunting spears, with hardwood head, usually have a barb at the tip, formed by laying a slim piece of wallaby-bone, wood, or (in recent times) iron, pointed at both ends, against the point of the spear, so that one end of the former forms the actual tip and the other the barb (fig. 129); this is bound and smoothed, as are splices. There is no doubt that iron has been used to some extent by the Walmbaria natives for more than a century. King (10), after describing the wreck of the *Frederick* on Stanley Island, says: "The natives appeared to have taken notice of the iron-work, for some spike nails were found about their fire-places."

Fig. 129. Tip and barb of hunting spear; Walmbaria tribe, Flinders Island.

Fishing spears are made in the same way as the others, but have three or four hardwood prongs, each from one foot six inches to two feet in length; the tips of these are usually barbed, as described, but sometimes terminate in plain points (fig. 111-113). Miniature spears of this sort are made for the children, who, however, always throw them by hand; as a rule adults use the throwing-stick with fishing spears, but sometimes throw them without. Numbers of small spears, with a slender hardwood shaft and a plain hardwood head, are also made (fig. 109-110); these are about six feet in length, and have the end of the butt hollowed to fit the peg of the wommera. These little weapons are commonly used by women and children to obtain crabs and small fishes in shallow water, and are then utilized without the throwing-stick. Harpoon shafts for dugong and turtle are similar to some of the North Australian types described by Roth and others, and more recently by one of the writers (11); the detachable head here illustrated (fig. 76) is from Barrow Point, and was secured at Flinders Island; it is thirteen inches in length, and is made of heavy hardwood, and has a wooden peg lashed to the tip, and coated with gum, to form a barb. A collar of string and gum about two inches from the base forms a plug, which fits the hollow end of the heavy shaft. Roth (12) states that this collar is absent on harpoons from Flinders Island examined by him.

(10) King, Survey Coasts Aust., i, 1827, p. 232.

(11) Tindale, Rec. S. Aust. Mus., iii, 1925, pl. vii, fig. 25-26.

(12) Roth, North Qld. Ethnography, vi, 1903, p. 32.

The highly decorative shields commonly used in the Cairns district, and some of which are five feet in length (fig. 130), are known to the Walmbaria natives by repute, but are never employed, as all spear-warding is done by means of the spear-thrower.

HUNTING AND FISHING: COLLECTING AND PREPARATION OF FOODS.

The Kokolamalama and Barunguan tribes, and some of the Walmbaria people, kill three species of wallabies with their spears; the most common is the agile wallaby (*Macropus agilis*). A black species of kangaroo occurs at Bathurst Head and in the vicinity, but is apparently very shy. The large red kangaroo

Fig. 130. Decorated shield; Hileman tribe, Mona-mona, Atherton Tableland.

(*Macropus antilopinus*) is also sometimes seen in the coastal districts of Princess Charlotte Bay. The insular Walmbaria people, who belong to a kangaroo totem, refrain from killing and eating the red kangaroo, even on the occasions of their visits to the mainland, and this prohibition will also prevent them from eating the nail-tailed wallaby. No amount of persuasion would tempt Wondal, a Stanley Island native, to eat a portion of one of the latter animals, although he had had little food for two days.

The mainland Walmbaria showed great aversion to hunting or molesting the native companion. When foraging for food to augment dwindling stores they persisted in remaining in camp, after enlisting the aid of Kokolamalama men of other totems to assist one of the authors in a hunt for them. In like manner it was difficult to persuade Ambarabara (Mutumui tribe) to accompany the writers when shooting big kangaroos, although he eagerly assisted in stalking rock wal-

labies. These inhibitions are caused by the desire not to molest the particular totem animals with which the individual claims relationship. The same relationship between the totemic object and the tribesmen exists in all the tribes under consideration.

Eggs of the scrub-turkey (*Talegalla lathami*) and other large birds are collected and eaten, and the birds themselves are snared or speared. Goannas (*Varanus*) are not uncommon on the mainland, and two species, *Varanus gouldii* and *V. punctatus ocellatus*, occur on the Flinders Islands; these and frogs (which are ever abundant on the mainland during the wet season) are freely used as food, and pictures of the batrachians and reptiles are not uncommon in rock-shelters. As is to be expected in the case of coastal natives, much food is obtained from the sea, and for securing most of the larger marine creatures the spear serves well.

The natives throw their spears with great accuracy, whether by hand alone or with the aid of a spear-thrower, although the weapon is, of course, projected with much greater force with the last-named. One day we watched a man, with a fishing spear in each hand, walking along a low cliff overlooking the sea. A mullet flashed out from under the rocky ledge, and in a wink the man had thrown his two spears, using each hand in turn; both spears transfixed the fish. When conditions are favourable a man, working in shallow water with a single spear, will, in an hour or less, capture as many fish (small sharks, mullet, and so on) as he can carry.

Just inside the eastern end of Princess Charlotte Bay is a large rock, jutting out into deep water. It is hollowed beneath, and the Walmbaria men, spear in hand, dive down and transfix rock-cod, groper, and other fish sheltering in this under-water cavern.

The Flinders Island natives evince great fear of the stone-fishes (*Synanceja horrida* and *S. verrucosa*), and are well aware of the sometimes fatal results accruing from the poisoned wounds occasioned by treading on the fish as they lie partly buried in soft mud; the severe and prolonged effects of *Synanceja* venom have been recorded recently ([13]). When wading in shallow water both men and women tread carefully, watching for signs of this dreaded fish; if possible, they travel in single file, each stepping into the footmarks of the leader. When a stone-fish is discovered it is invariably speared, and if the fishers are near camp it is carried there on the points of a spear to be exhibited, and, as mentioned above, the spines may be used to tip spears.

Crocodiles are not abundant at the Flinders Islands, although we saw two in

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([13]) Duhig and Jones, Mem. Qld. Mus., ix, 1928, pp. 148-150; Aust. Journ. Exp. Biol. and Med. Sci., v, 1928, p. 173, etc.

the mangrove swamps there. In the Stewart River, however, the reptiles are fairly common, and the Barunguan natives kill them at every opportunity. If they manage to "corner" a crocodile in some narrow reach or backwater, they first prod out its eyes with their spears, with the object of placing it at the greatest disadvantage before the coup-de-grace is administered.

Fig. 131. Child digging out Swift Crabs at Flinders Island.

Fishing in deep water is usually carried out by hook and line, although the pearl-shell hook, and other hooks of native manufacture, are things of the past, owing to the introduction of European fish-hooks by trepangers. Swift-crabs (*Ocypode ceratophthalma*) and hermit-crabs are commonly used as bait. The first-named move so quickly that, to obtain a supply, the natives usually dig them out from their burrows in the sand (fig. 131). The hermit-crabs are easily obtained, for on Flinders Islands we noticed that, both during the day and at night, these crustaceans collected themselves together into heaps at low tide, a single heap sometimes consisting of two hundred or more individuals; a somewhat similar habit of hermit-crabs, when sheltering from the sun, has been noticed in Roebuck Bay, Western Australia (14), and in Africa (15). The hermit-crabs

(14) Knut Dahl, "In Savage Australia," 1926, p. 269.

(15) Schmitt, Bull. Amer. Mus. Nat. Hist., liii, 1926, pp. 54-55, pl. ix, fig. 1.

are prepared by deftly breaking the protective mollusc shell with a stone; on Stanley and Flinders Islands these broken shells occur in considerable numbers in places where bait is obtained thus. Apart from sometimes collecting running-crabs and hermit-crabs for bait, children "hunt" small marine animals, which are apparently not utilized either as food or bait, and at low tide sometimes amuse themself by throwing small sticks and pebbles at the mud-skippers (*Euchoristopus kalolo*) resting on the mangrove roots, rarely failing to knock them over. They obtain the little mole-crab (*Hippa adactyla*) and the smaller sea-lice (*Excirolana orientalis*), both of which are common near the Flinders Islands, by scratching rapidly in the sand at the water's edge; in fact, they early show a knowledge of the habits of all animal life in their tribal area, whether or not it be of economic import to them.

Fig. 132. Brush fish trap in a creek at Bathurst Head.

Several old men at Bathurst Head told us that "a long time ago" whenever a sucking-fish (*Remora*) was secured it was used to assist in spearing turtle. They stated that a line was fastened around the caudal peduncle in such a way that the fish was not injured; a turtle basking at the surface of the sea was cautiously approached, and the remora was carefully thrown in the direction of the chelonian, to which it attached itself. The natives were then able to carefully haul the creature to within spearing distance.

We saw an old fence fish-trap at Walaeimini, on Bathurst Head. This was built across a small mangrove creek, so that fishes passing over it at high tide were caught behind it as the water ran out. It was made of brush, and had been about twenty-five feet in length (fig. 132).

Vegetable poisons, as has been described by Roth and others, are sometimes used to stupefy fishes in large rock-pools, etc. Both the Walmbaria and Barunguan natives use bag-like, shallow fishing nets, which are fastened to oval frames, formed by lashing together two or three pieces of cane or saplings. These nets are made of wattle-bark fibre, or of *Livistona* fibre twine, and various meshes are employed in different nets. They are operated in the sea, the fishermen wading out until they are waist deep. Often two or more such nets are used at once, and many persons participate. Each net is grasped by two men (one at each side of the frame), who scoop it forwards through the water just below the surface, and raise it at arm's length at frequent intervals for examination. Meanwhile a wide semicircle of men splash the water in front of the operators, and so scare fish towards them (fig. 133-134). Surprisingly large fish (mullet, snapper, and so on, three or four pounds in weight), are captured by this method.

Fig. 133–134. Fish nets in use at Flinders Island.

The large Crustacea—the fresh-water crayfish, the mangrove crab (*Scylla*), the blue crab (*Portunus*), the rock lobster (*Panulirus*), etc.—are collected by the women, although the men sometimes spear the last-named. Crustaceans are often placed intact on hot coals to roast, but sometimes the Walmbaria women, having obtained a large *Scylla*, take off the carapace, remove all the flesh from the rest of the body and legs, and place it in the "shell," which is then put on the fire and the meat cooked therein. The Flinders Island people designate the mangrove crab (their main edible crab), 'apoyi,' and most of the other smaller crabs are either 'apoyi-indilka' (medium-sized crabs, such as *Thalamita*), or 'apoyi-anga' (very little, or baby, crabs). Nevertheless, some of the small crabs, either because of some noticeable peculiarity, of because of their plentitude or economic importance (for instance, those used as bait), have special names.

The Walmbaria and Barunguan natives apparently always roast their fish, dugong, and turtle. If two or three men are hunting some distance from a camp they cook their fish before returning with them. Small sharks are relished, and their livers in particular are considered a great delicacy; these fish are placed on the embers for a few minutes, they are then taken out, opened with a finger, and the livers extracted, after which the roasting is completed. If the cooking is not undertaken in camp, the removed livers are carefully wrapped in grass or bark for transport.

Oysters are collected mainly by the women, but men also assist them occasionally. Oysters are smashed by hammering with a stone, and the animals are picked out from the broken shell and are boiled. This method of preparation did not commend itself to us during the time we were dependent on native food, for we found that the cooked molluscs were plentifully mixed with splinters of shell.

A large land shell (*Thersites bipartita*) is found in abundance after the first rains of the "wet" season, and this also is boiled. Smaller molluscs are sometimes collected in the mangrove swamps, and are mixed with other "dishes," such as those of green ants, described below.

As usual, the grubs of large moths and beetles, the larvae of bees, and various other insects are eaten. The Mutumui and Walmbaria tribes prepare a concoction from the ever-abundant green ant (*Oecophila smaragdina*), both on the Flinders Islands and on the mainland. The women collect great quantities of these ants from their nests in the trees into bark dishes; on reaching camp they are tipped into baler-shells or other receptacles, and mashed. Plenty of water is then added to the crushed mass; this water is drunk with relish, and the mashed ants are then eaten.

Of the Princess Charlotte Bay natives, at least those of the Barunguan tribe employ a length of lawyer cane (*Calamua*) for securing honey. One end of a long cane is frayed till it forms a brush (fig. 78-79); the brush-like end is inserted into the opening in a tree leading to a bees' nest, and is twisted about until a mass of honey and comb is collected on it. The Barunguans stated that some of the bees (namely, the introduced species) are "plenty hot fellow."

Roth ([16]) has published a long list of the vegetables and plants eaten by the natives of Northern Queensland. The tribes encountered by us made use of any plant, root, fruit, or plant-exudation which their districts afford, and which by any stretch of imagination can be termed edible, especially when they are lacking meat or fish. Many of the small fruits, such as that of *Buchanania*, are eaten raw, without any preparation. Several kinds of edible fruits drift into Princess Char-

([16]) Roth, North Qld. Ethnography, iii, 1901, pp. 9-16.

lotte Bay during that part of the year when a current sets into the coast, and are picked up on the shores. Bone spatulae (fig. 124-127) and small pieces of bone (fig. 128) are used in the preparation and eating of some vegetable foods.

The yam (*Dioscorea sativa*) is, of course, much utilized during the wet season. The roots are plentiful on parts of Flinders and Stanley Islands, where the women dig them out with yam-sticks (fig. 77). At places on the rocky slopes of Flinders Island the tubers are abundant, and are found in such places as far as 1,000 feet above sea-level; to secure them the natives dig down between rock crevices filled with earth, and often overturn large stones in their efforts to obtain the delicacy. Some of the holes excavated in these crevices were only nine inches

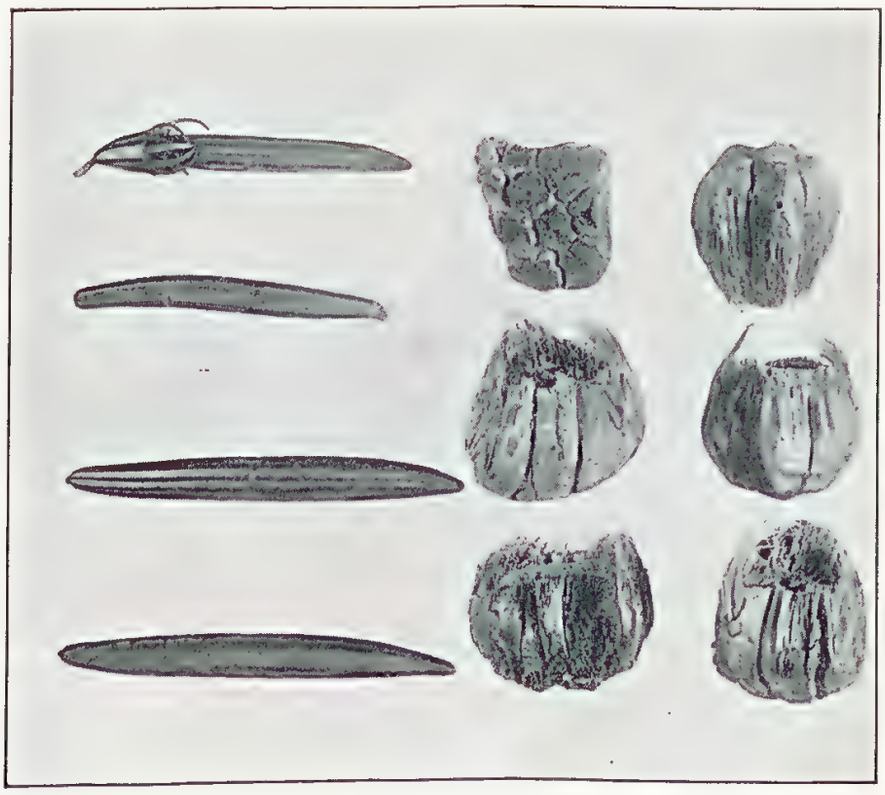

Fig. 135. Mangrove fruits.

Fig. 136. *Pandanus* fruits prepared for eating.

or a foot in diameter, but were quite five feet in depth. Where the yam is abundant hundreds of these deep holes are evident in a comparatively small area. Women on Flinders Island claim that they always throw back into the hole a portion of the yam vine after removing the tuber, with the injunction to go and make more yams; we saw no evidence of this practice when examining the holes.

The Walmbaria people grate the yam tubers against a stone, catching the resultant pulp in a baler-shell; this is washed in several changes of water, and boiled to form a sort of gruel or sago-like mass, which is much relished.

The rhizomes of a small species of lily growing in the shallow waters of lagoons are collected on the mainland by women, who use a short hardwood stick, like a miniature yam-stick, to lever them out of the mud.

During lean periods the fruits of the screw-pine (*Pandanus*) and of two species of mangroves are gathered. The pandanus fruits are thrown on to a fire until charred, after which one end of the husk is cut off (fig. 136) with a sharp-edged stone or some other implement. The tiny elongate roasted "nuts" are then picked out with a long splinter (fig. 137) of bone or wood; when this food alone is available much time is occupied in thus tediously obtaining enough nutriment to satisfy the appetite.

Fig. 137. Picking the roasted "nuts" from prepared *Pandanus* fruits.

We witnessed the preparation of the fruit of one of the aforementioned mangroves, and were told that a more spherical fruit of a second species was also used. The fruits (fig. 135) are collected at low tide, for the trees apparently grow towards the middle of the swamps. When camp is reached a small, hot fire is made, and for thirty or forty minutes stones are heated therein. The fire is then raked out, and the mangrove fruits are thrown in amongst the hot stones, which are distributed evenly amongst them with a stick. The heap is then covered with a piece of paper-bark, and this in turn is covered with a layer of sand an inch or so in depth. The mass is left undisturbed for about an hour, after which the covering is taken off, and the roasted fruits (now brownish-grey instead of green) are removed. When they are cool enough to handle, the tops are pulled off and thrown away, after which the fruits are picked up, one or two at a time, pounded between two stones, and thrown into a baler-shell. They are next tipped into an open-work basket and taken to the beach, where a large container

is filled with sea-water. With the basket standing in the salt water in this dish, the woman vigorously kneads the crushed mass; the water becomes yellow and then milky as the floury contents of the fruits pass through the open meshes of the basket. After fifteen minutes or so of kneading, the husks are thrown out of the basket, and the floury sediment in the dish is allowed to settle, a rising scum on the surface being skimmed off meanwhile. The water is then carefully poured off, and the sediment similarly washed in a further change of sea-water. After the second "pouring off" the thin, mushy sediment is tipped into a closely-woven dilly-bag, which is squeezed to get rid of excess water, and finally undergoes two washings in fresh water, with much kneading between each. This mangrove fruit mash resembles paper-pulp of a greyish colour, but is eaten with evident enjoyment when other food is scarce.

Fig. 138. Digging for fresh water near the margin of the sea; and fig. 139, testing the water seeping into the excavation; Barunguan tribe, Pt. Stewart.

Fresh water is not available in unlimited quantities in the districts occupied by the Walmbaria and Kokolamalama tribes, particularly during the dry season. In the wet season small creeks are filled intermittently on the mainland, and at other times various small soaks and wells provide a supply, although the old men sometimes have to "sing" for rain or enlist the aid of rain-makers (fig. 55-56). The dry and barren Flinders Islands have no permanent streamlets—in fact, water draining into any of the small courses runs only for an hour or two after rain—but several inconspicuous soaks provide water, while (as mentioned in the

introduction to this paper) H.M.S. *Dart* visited Flinders Island in 1899 and cleared out a well, which furnishes murky but palatable water, which is used by the natives and by the trepangers.

The Barunguan people have the Stewart River as a source of water supply. At the mouth the water is salt or brackish at low tide, but at high tide the surface-water is usually somewhat fresher.

On several occasions we noticed natives digging holes in the sand only a few yards from the margin of the sea at Stewart River (fig. 138-139). These holes rapidly fill with water, and the digger dips a finger in the fluid, and tastes it to ascertain whether it is fresh or brackish; if it proves too salt he tries other places. Tolerably sweet water is obtained in this way when the river water is quite unfit for drinking.

The Walmbaria people stated that at one time they were in the habit of eating human flesh. When food became very scarce at the end of the dry season, and especially when dugong hunting had long proved ineffective owing to rough weather, meat hunger led them to kill adults. Persons killed in quarrels were sometimes disposed of in the same manner; newly-born children were eaten, especially if a second appeared before the first was weaned. In such cases the child would be struck on the nape of the neck with a yam-stick, or its mouth would be filled with beach sand.

NATIONAL MUSEUM VICTORIA.

ABORIGINES OF PRINCESS CHARLOTTE BAY, NORTH QUEENSLAND

PART II.

By HERBERT M. HALE (Director) and NORMAN B. TINDALE, B.Sc., (Ethnologist).

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CANOES.

Wooden canoes of two types were seen in the Princess Charlotte Bay district, and as they both belong to forms similar to those described by Roth (17) our comments are brief.

At Flinders Island and Bathurst Head the type in favour (fig. 146-148) has a single outrigger ('appa') placed on the right (starboard) side of the hull and supported by six pairs of horizontal arms ('aipar') lashed to pairs of crossed sticks, usually of mangrove wood, driven obliquely into the outrigger log (fig. 149). The outrigger booms are passed through rectangular holes cut in side boards, which are lashed to the sides of the canoe after the spaces between them and the hull have been packed with paper bark pads.

A canoe of this type is made from a tree felled in one of the rain forest areas near the mouths of the rivers entering Princess Charlotte Bay. It is roughly trimmed on the spot with an axe and then carried to the nearest water, whence it is floated to the beach for final dressing, the latter taking several weeks. Formerly the axe used was of stone, as in the specimen shown (fig. 168) from the country further south. Both at Flinders Island and at Stewart River metal equivalents have been in use for at least two generations. Kokolamalama people make canoes ('tuppal') of this character, and trade them to the Mutumui in

(17) Roth, Rec. Aust. Mus., viii, 1910, pp. 12-14, fig. 11-13.

return for shell ornaments ('anir, omareru') and spears ('alka, awita'). The Mutumui also give them bloodwood gum ('otara') and ochre colours, obtained by trade from people further to the south.

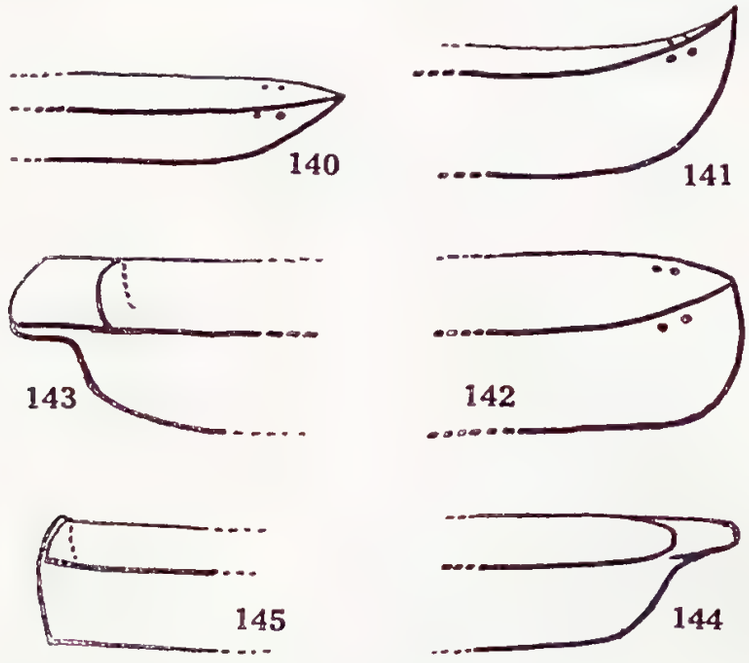

Fig. 140–142. Bows and (fig. 143) stern of single outrigger canoes; Walmbaria Tribe, Flinders Island. Fig. 144. Bow and (fig. 145) stern of double outrigger canoes; Barunguan Tribe, Stewart River.

The Walmbaria also trade with the Kokolamalama for canoes, offering spears tipped with stingray spines and with metal obtained from a wreck on Stanley Island. They call the canoes 'akaala'. Several types of prow ('alpayi') (fig. 140-142) are recognized, and are specially characteristic of different canoe makers. Stern pieces ('turiene'), in the form of a projecting flat counter (fig. 143) are a consistent feature. Propulsion is by means of paddles ('wiriapu') and long poles. The paddles are some four feet long, with the flat extremity abruptly differentiated from the handle, not tapered and merging into it, as is the case with some from the Gulf of Carpentaria.

An example of the 'akaala' canoe from Flinders Island (the one shown on fig. 148) is in the South Australian Museum collection. Its overall length is 16 feet 6 inches and it has a beam of 16 inches. The outrigger is 12 feet long and 6 inches in greatest diameter. It is lashed at a distance of 2 feet from the hull of the canoe. It is made from a special type of light drift-wood which floats ashore along the coast, and is much sought after because of its special characters.

Canoes of this type were used by Mutumui and Walmbaria natives in travelling as far south as Cape Flattery (to Cooktown in modern times), and occasionally to Stewart River.

Fig. 146–148. Single outrigger canoes of Walmbaria Tribe, Flinders Island; 146, canoes drawn up on the beach at Apa; 147, poling a canoe in the shallow water of Owen Channel, Wilpianta Point in background; 148, paddling a canoe, Owen Channel, Tantini camp in left background.

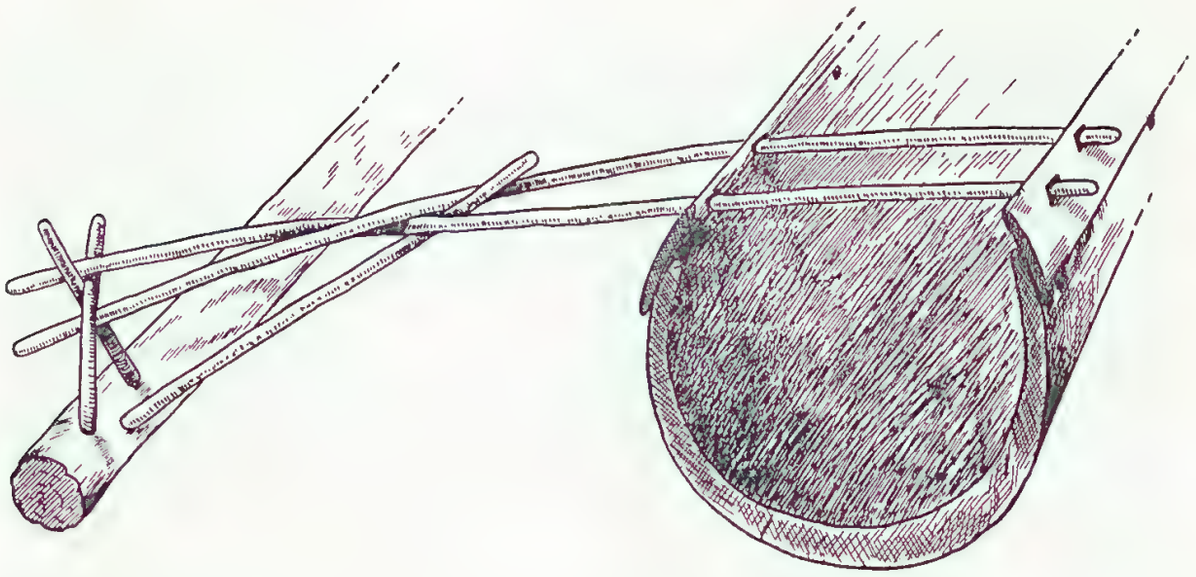

Fig. 149. Method of mounting outrigger (lashings and bark pads omitted); Walmbaria Tribe, Flinders Island.

The Barunguan people use a double outrigger canoe called 'tanju' (fig. 150-151). This is hollowed out from a tree in the riverine jungle of the Stewart or Rocky Rivers in the same manner as is the single outrigger further south. The bows are not sharp, as in the Flinders Island canoes, being well rounded, with a projecting lip-like prow (fig. 144 and 150). The stern is usually truncated (fig. 145); occasionally it may have the general form of the 'turiene' of the 'tuppal' canoe.

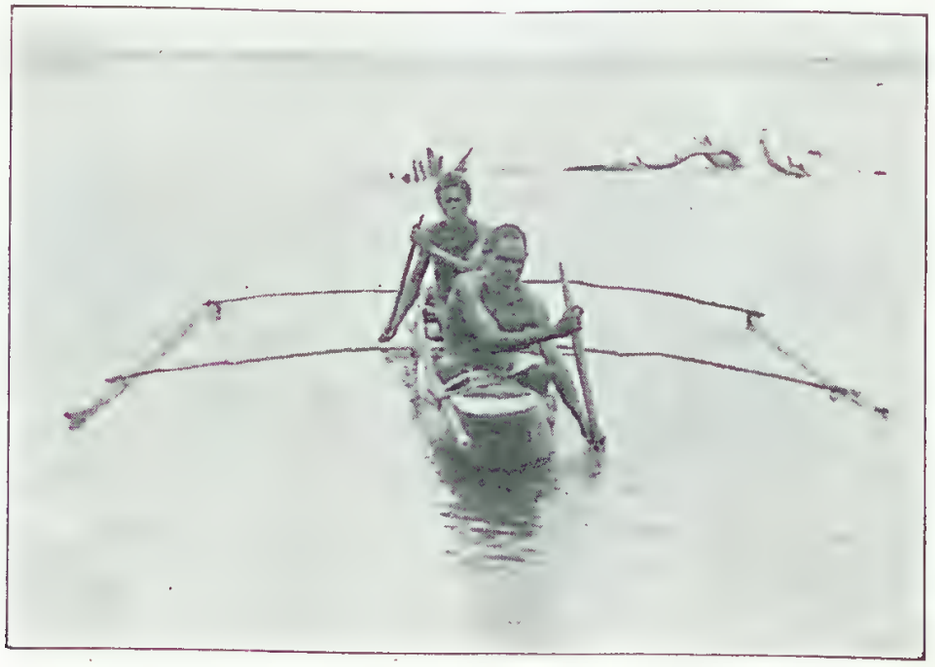

Fig. 150. Double outrigger canoe; Barunguan Tribe, Stewart River.

The two outriggers of the 'tanju' canoe are supported by a pair of long, flexible booms. It will be noticed (fig. 150) that these booms are lashed directly to the outrigger poles and to the gunwales, one being nearly amidships and the other near the stern. The outriggers do not reach forward to the line of the bows, as is usually the case in the 'tuppal' canoe, and, contrary to Roth's experience, the examples witnessed all had the booms lashed to the top and not piercing the hull of the vessel, the lashings themselves being passed through one or more small holes in the gunwale (fig. 151).

Fig. 151. Baling double outrigger canoe with a shell dish; Barunguan Tribe, Stewart River.

Canoes of the double outrigger type are common to the Barunguan people and the natives near Cape Direction. They are not made by natives south of Running Creek.

The equipment of a Barunguan 'tanju' includes two or more paddles, a baler (usually a *Melo* shell with the inner shell whorls removed, fig. 151 and 177), a dugong harpoon and rope, a large stone tied to a rope to serve as anchor, pads of paperbark to act as cushions for the paddlers, and various fishing lines, bait, and other incidental objects.

We disagree with Roth's theory that the single outrigger canoe of Flinders Island is a local modification of the double outrigger, in which the outriggers of one side have been suppressed, and the side boards and an extra number of booms added in order to increase stability. The local evidence is rather more in favour of the idea that they are both due to external cultural influences, different in time, and that the double outrigger canoe is likely to be a later acquisition than the single outrigger vessel.

TRADE ROUTES.

The Flinders Island natives trade with the mainland, obtaining heavy wooden spears and canoes in exchange for stingray-barb spears, throwing sticks, and woven bags. The canoes are obtained from the Kokolamalama people in the south-western corner of Princess Charlotte Bay, where suitable big softwood trees grow. Hardwood spear-throwers and their baler shell ornaments are made at Flinders Island and on Bathurst Head for trade to people further south and east, as mentioned on p. 101. Red ochre and bloodwood gum are produced in the Starke River district, and find their way north either by canoe or by an overland route which crosses from Barrow Point to Mack River, and thence along the coast to Bathurst Head. Pipe-clay is found on the south side of Flinders Island, and is carried to the mainland. The natives of the Walmbaria and Mutumui tribes are of a wandering disposition, and parties may travel in single outriggered canoes as far south as Cooktown. They do not appear to go further north than Dhu Reef (Yangalmini) or Clack Island, and seldom venture further west than Saltwater Creek. The Barunguan people, who wander north as far as Weymouth Bay, use the smaller double-outrigger canoes; they are less venturesome sailors, possibly because there are few islands (except Night Island) of any size which they are able to visit.

Natives who were engaging in a trading venture left Flinders Island at daybreak when the sea was calm, secured spears on the mainland by trading from Kokolamalama men, and returned at dusk when the wind had dropped. Favourable light winds are magically induced by the old men, who light a special smoke fire and chant over it a phrase involving the use of the word "wind". A successful trading visit to Tartali is carried out with a certain degree of formality; on the morning decided upon for the voyage no mention is made of the journey until the canoe and its occupants have arrived opposite a place called Tilpanga, where there is a rough cylindrical stone about eighteen inches in height standing upright amongst the sandstone boulders on the point (p. 91 and fig. 61). This was erected in the past by a legendary old man to mark the place from which canoes should leave for the mainland. One of the men will say: "There is no wind, let us go to Tartali"; or if the wind springs up he will say: "Let us go back to Apa". Having decided to proceed with the journey the ban of silence is lifted and plans may be discussed in detail as the natives paddle across from Tilpanga to the east coast of Wakayi. They then pole their canoes in the shallow rock-strewn water in the lee of that island until opposite Edaimbar. Here they resume paddling, attempting to strike the mainland at Worei, but sometimes they are carried into Wakarma by the powerful tidal current which races through the passage. The

Kokolamalama people frequently camp on the second bay on the west side of Bathurst Head, where there is a permanent fresh-water well and much shell-fish food to be obtained on the rocks. The voyagers pole along the shore, stopping frequently to gather oysters and to spear fish in the shallow waters of Walaeimini Bay. On arriving near a camp of the Kokolamalama people they light a signal smoke, and moving forward still closer, sit down, fully armed, for perhaps half an hour. An individual of the mainland tribe, followed and supported by a group of armed fellow-tribesmen, then approaches with uplifted spear, and shouts out a series of grievances they bear against the islanders. He then hurls the spear at them. If they are welcome the spear will not travel more than two-thirds of the distance towards them. Another man may then come forward with a firestick. Bartering does not take place. A parcel of trade objects is simply placed in the mainlanders' camp, and when they are about to depart a return offering is produced and placed near the camp of the islanders. Open criticism of the return exchange is seldom made while the islanders are away from their own country; any deficiencies are remembered and are brought forward as grievances when the mainlanders repair to the islands on similar visits.

CAMPS AND SHELTERS.

The camps ('ambawanga') of the Walmbaria natives may be classified as temporary and semi-permanent. The former may be constructed by small parties during hunting excursions away from the principal shore camps, or when the tribespeople intend to remain in one place for a brief time only; in such circumstances erected shelters differ considerably from those of camps, which may be occupied continuously for longer periods up to several weeks or months. A typical temporary rainy-season hut, built during a short visit of some Flinders Island people to Bathurst Head, is shown in fig. 152. These Walmbaria huts are semicircular in shape, and only four or five feet in diameter at the widest part; they are formed of a framework ('iku') of thin saplings or canes, over which strips of bark ('waltja') are laid. Leafy boughs stuck in the ground around the huts, or laid on the bark roof, provide additional shelter from the heat of the sun; the open side faces away from the prevailing wind, and thus most of the rain is excluded.

The huts are much larger and higher in the more enduring camps, which are intended for weeks of occupation during the progress of the rainy season. The sapling framework is then built up in the form of a rounded dome with a circular base about ten feet in diameter (fig. 153). Bark is laid over this, completely covering the frame, excepting for a small doorway only twelve to sixteen

inches in height. The bark is then thickly covered with tussocks of grass (fig. 154). A hut of this type provides efficient shelter from all but the heaviest rains; the thick grass thatching renders it comparatively cool in the day and warm at night; driving rain does not seriously inconvenience the occupants, owing to the small size of the entrance, and this feature, and the ever-present smoke fire within the hut also mitigates the ubiquitous mosquito nuisance. The term used for hut is 'arrar', and to build a hut is expressed by the term 'aral-mininbala'.

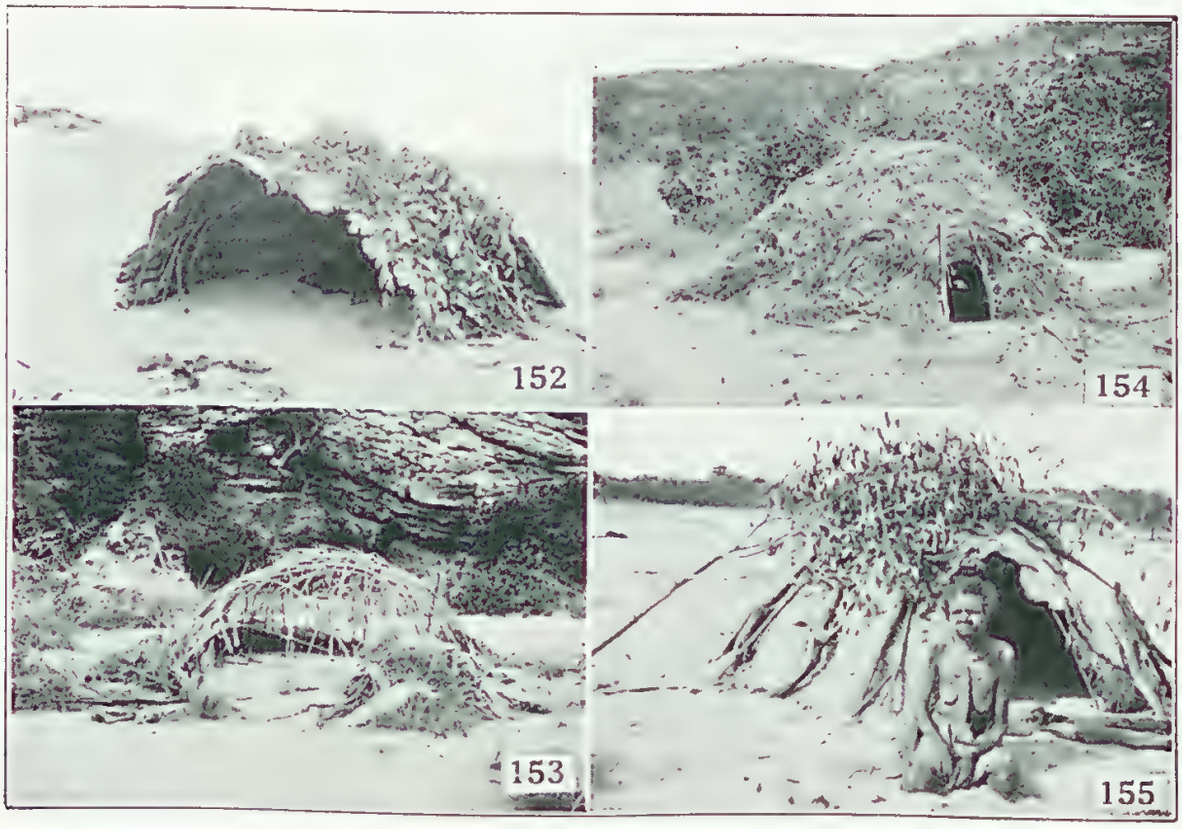

Fig. 152. Temporary hut at Bathurst Head; Walmbaria Tribe. Fig. 153. Sapling framework of large hut at Walkeiwa, Stanley Island; Walmbaria Tribe. Fig. 154. Completed large hut; Walmbaria Tribe, Worei, Bathurst Head. Fig. 155. Bark hut at Stewart River; Barunguan Tribe; in front is a widow wearing mourning tablet (compare fig. 67, 69).

Apart from these two kinds of sleeping-quarters, shade-huts are erected in the permanent camps. Four forked sticks, each about four feet in height, are placed upright in the ground; sticks are laid horizontally in the forks, and leafy branches, bark, or grass are laid over the sticks. When in camp the natives stay in the shadow of these covers all day, with their utensils and other personal belongings scattered about on the ground, and their spears on top of the shelters. During short visits to open beaches a shade is often provided for old men and children by merely placing leafy boughs upright in the sand.

Places where camps are regularly established—sites which have been period-

ically occupied for years—are unmistakably apparent owing to the quantity of food debris. Some of the kitchen middens on the Flinders Islands and on Bathurst Head are very extensive, and are marked by heaps of bones of turtle, dugong (see p. 93 and fig. 60), and fish, portions of shells of the mangrove crab (*Scylla*) and rock-lobster (*Panulirus*), as well as a vast quantity of mollusc shells, cockles, clams, various kinds of oysters, land shells, and so on, with the cockles predominating. Although, as previously mentioned, the Stanley Island section of the Walmbaria is to-day represented by only one surviving male, there is ample evidence in support of his statement that the island was at one time the home of many people. Kitchen middens on the shores and inland cover acres of the small island and show that abundant food was available.

The Barunguan people at Port Stewart erect dome-shaped huts ten to twelve feet in diameter, covered with bark and shaded with boughs. In all seen by us the doorway was much larger than in those made by the Walmbaria people, and in some cases one side was completely open, as in the small temporary huts of the last-named tribe (fig. 155-156).

Rock-Shelters.

The only type of shelter to which the term "permanent" can be justly applied is that afforded by caves and rock-shelters ('edidana'), which, when commodious, are occupied by large bodies of natives, sometimes for long periods, and particularly during the wet season. Food debris is naturally abundant in and around these ever-available retreats.

We examined several of the rock-shelters utilized by the Walmbaria people. In addition to ten moderately or very extensive examples, many small shelters were noted. In some cases the last-named consist merely of a leaning rock, which offers protection from the prevailing wind (fig. 157), but even in such, accumulated food debris is often abundant. The main shelters include three large caves at Endaen, on Stanley Island and seven on Bathurst Head. At Endaen there are six caves within a half-mile radius which show signs of occupation; only one contains rock-paintings. The last-named was the principal camp of the Stanley Island group of the Walmbaria tribe within recent times, and it is by far the largest and most imposing of all the rock-shelters examined; hereafter it is referred to as the "Endaen shelter". Captain Phillip P. King ([18]) notes that during one of his visits to the Flinders Islands, Mr. Allan Cunningham (the botanist on board) visited a rock-shelter on Stanley Island, apparently one of those on the declivities of Castle Peaks, in which no paintings were apparent. Cunningham, in the notes quoted by King, says that "The general mass on the

([18]) King, Survey Coasts Aust., i, 1827, pp. 378-379.

slopes or declivities are deeply excavated, furnishing spacious retreats to the natives. I entered one of these caverns . . . . a large natural chamber, capacious enough to hold conveniently a large tribe of natives, who, from the numerous fire-places, broken turtle staffs, and other relics, had not very long since dwelt there''.

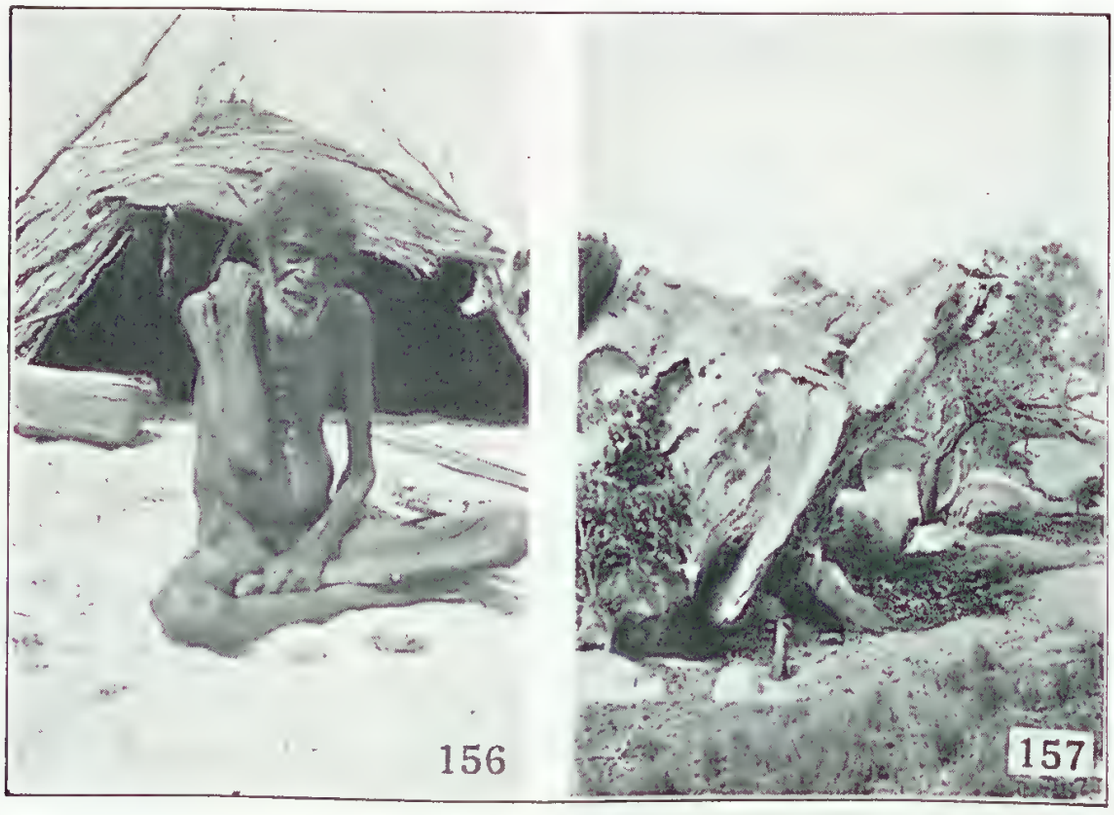

Fig. 156. Paper bark hut; Barunguan Tribe, Stewart River.

Fig. 157. Leaning rock forming wind and rain screen for small camp; Walmbaria Tribe, Flinders Island.

The Endaen shelter, which we examined in some detail, is formed by extensive natural undermining of a cliff near the north coast of Stanley Island, and consists of two easily accessible chambers or caves. That at the eastern end is the main part of the shelter (fig. 158); here the cliff is undermined to such an extent that there is an overhanging rock roof twenty-five feet in width at its broadest part and approximately one hundred feet in length; the shelter is from eight to ten feet in height, and is rendered more effective owing to the fact that a huge mass of fallen rock partly protects the opening, which faces north-west. Towards the western end the floor rises at a rather steep slope, and leads into another extensive cavern, the roof of which is honeycombed with holes in which owls nest. This chamber and a small and almost inaccessible cave in the rock face above show no signs of occupation. The large eastern chamber exhibits many evidences of prolonged habitation. The walls and roof are covered with hundreds of paint-

ings (fig. 161), and we estimated that the talus of food remains, ashes, and other occupational debris situated near the fallen rocks to be at least eight feet (at most twelve) in depth; the food remains consist largely of bones of turtles, fish, and dugongs, shells of cockles (principally *Arca trapezia*), oysters (*Ostrea*) and other shell-fish, also birds' eggs.

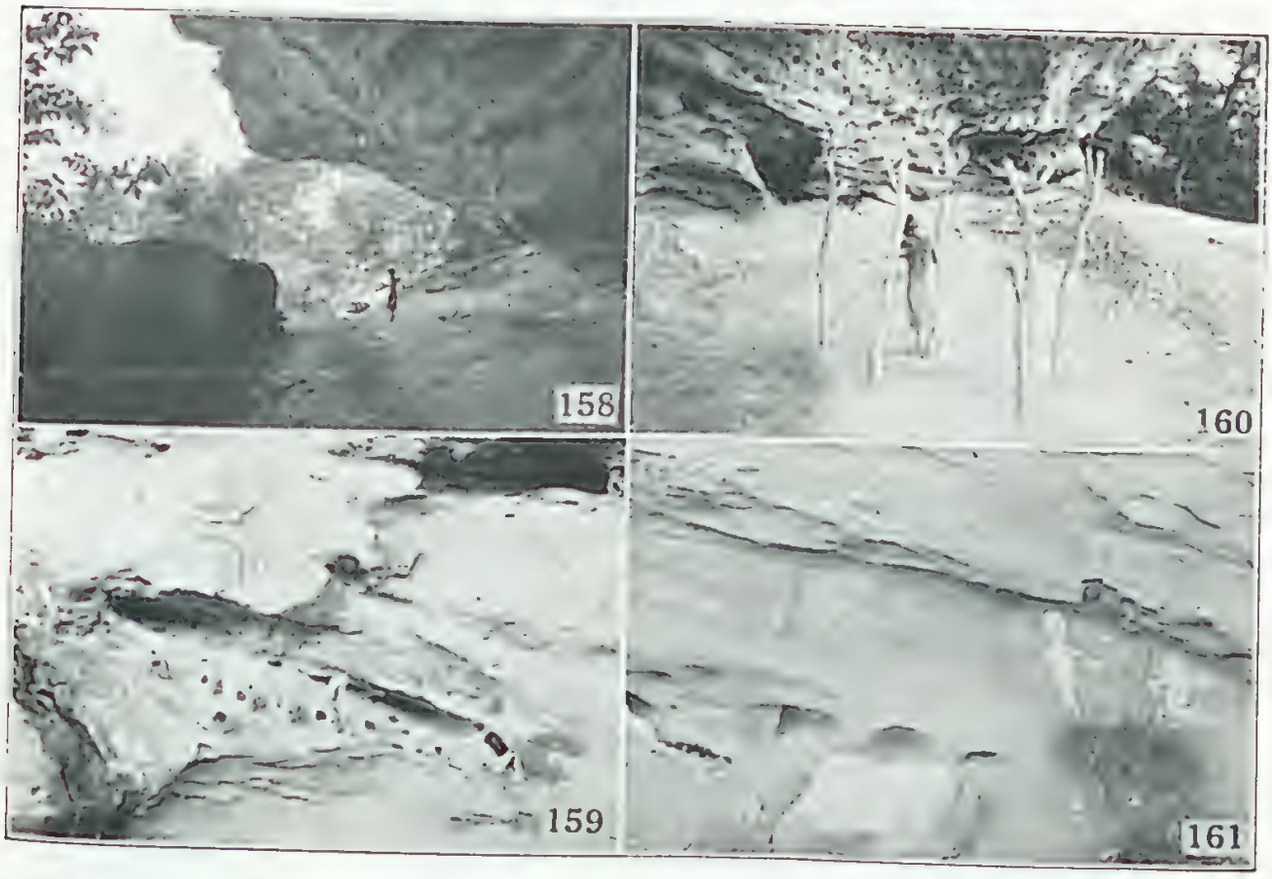

Fig. 158–161. Endaen rock shelter; Walmbaria Tribe, Stanley Island; 158, general view; 159, turtle heads and dugong bones of ceremonial import; 160, framework of an elevated sleeping rack; 161, paintings on wall, and stone slab used for grinding colours.

On a ledge, and in a crevice nearby, at the eastern end was a series of painted turtle-heads (fig. 159) and some dugong skulls (see p. 85). A wooden framework, relic of a sleeping rack or two-storied hut similar to those described by Roth, occupied a portion of the floor (fig. 158, 160).

Away from the food-mounds and fire-places, the floor is covered with fine dust, and in this, near the back of the shelter and beneath the widest part of the overhang, are the sleeping-places—soft and dry throughout the wet season. We prepared a plan of this camping place (fig. 162).

At Wakarma Beach, on the north-east coast of Bathurst Head, is a shelter which consists of a somewhat flattened block of sandstone perched at an angle on three other boulders. This has been used as a camp, and there are paintings on the underside of the roofing boulder (fig. 227).

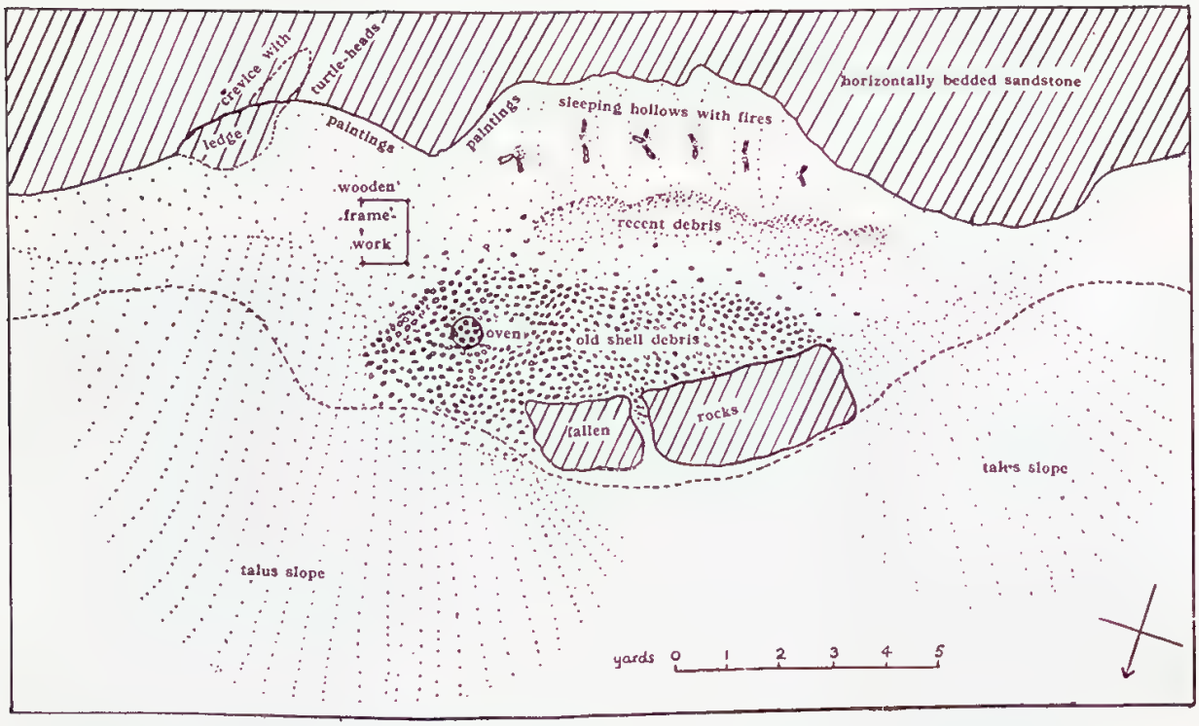

Fig. 162. Ground plan of Endean rock shelter; Walmbaria Tribe, Stanley Island.

About half a mile to the west of Wakarma is the Worei camp, which includes two shelters worthy of mention. The first and largest is situated at the western end of the little Worei Bay, facing the sea. The cave proper is wedge-shaped, and has a floor area of about two hundred square feet; the smoke-blackened roof is about six feet above the floor at the front, and only a foot or so at the back. Large masses of rock have fallen from the cliff above, hiding the true entrance,

Fig. 163. East Worei shelter, with native staff of Expedition; Bathurst Head.

but leaving an inverted V-shaped gap about five feet in height, through which one passes to reach the cave proper (fig. 163). This shelter is thus closed in on three sides; although rain drifts through various crevices near the front. During a visit to the place we used this retreat for a time in order to keep our gear dry; as shown in the photograph the partly protected ante-chamber formed by the fallen rocks is large enough to accommodate a tent, while the cave behind proved useful as a store for perishable goods. The roof of this inner cave is covered with paintings.

Another shelter at Worei is situated a little further to the west; it consists of a vertical rock-face, twenty feet in height, protected from the weather by a jutting ledge.

Fig. 164. Walaeimini shelter; Walmbaria Tribe, Bathurst Head.

Following the coast a little further to the west one comes to the large Walaeimini camp site, and striking inland for a short distance may find a large shelter adjoining the camp (fig. 164). Here a long notch has been weathered out by former marine erosion at the base of a low hill of Triassic sandstone (fig. 164). The retreat is about forty feet in length and only four or five feet from floor to roof, so that nowhere in it can a man stand upright or walk with comfort. At its widest part the shelter extends inwards about fifteen feet. The main part of the cavity opens to the north and north-east, and faces open, marshy country with black soil, in which tracks of game are plentiful. The smoke-blackened roof and

the back wall present small rock faces due to the presence of joint planes in the sandstone. The food debris on the floor is, on the average, only a foot in depth, and consists largely of one species of cockle (*Arca trapezia*).

At the time of our examination there was a large flat grinding-stone, weighing maybe a hundredweight, at the south-eastern end of the cave. Three deep, dish-like depressions had been ground into the surface as a consequence of generations of use as a nether millstone.

At the Wobolni camping-place, on the most westerly point of the north coast of Bathurst Head, are also three rock-shelters containing native paintings.

CAMP UTENSILS.

Several of the domestic implements in common use have been referred to in the accounts of the preparation and collecting of foods; in addition the following were seen. The Walmbaria, Kokolamalama, and Barunguan tribes make fire by twirling between the palms of the hands a thin stick (held in a perpendicular

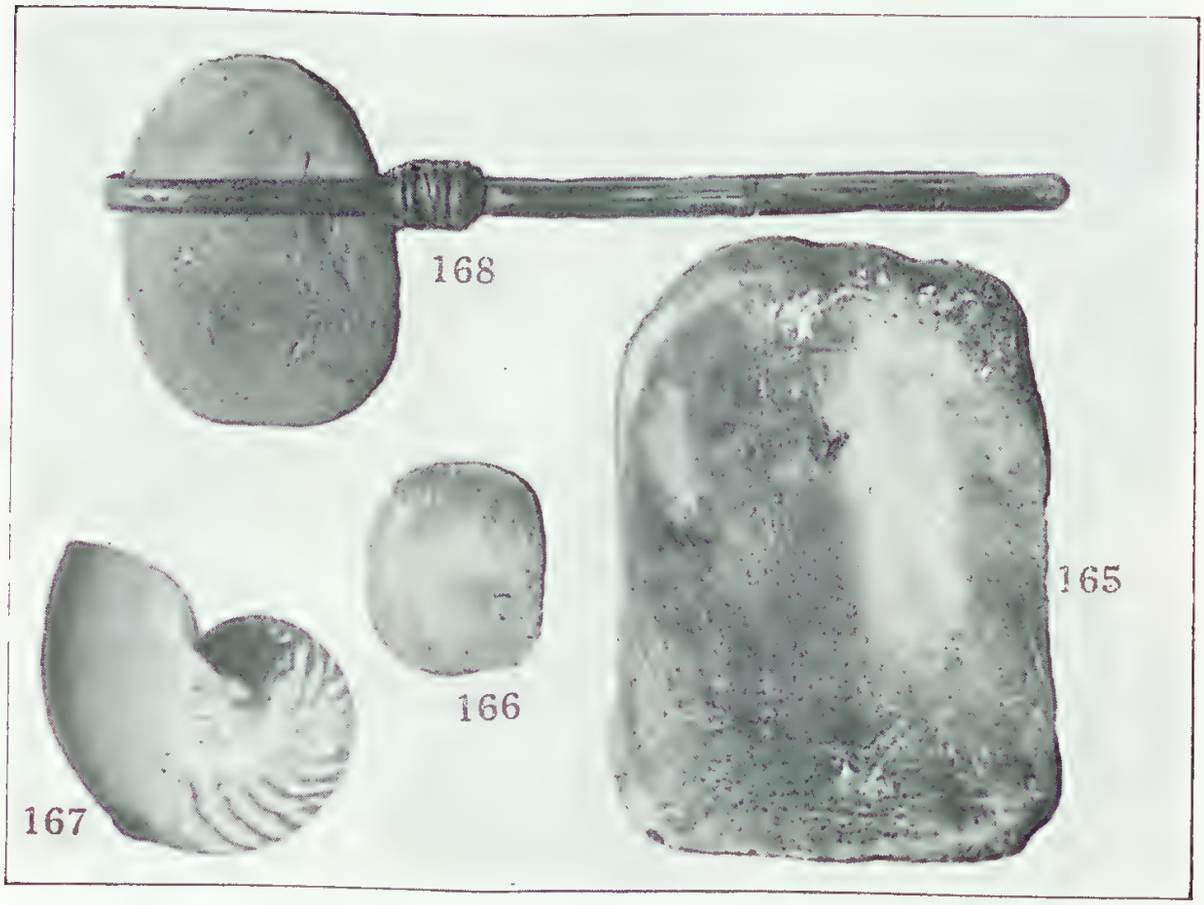

Fig. 165. Large nether mill-stone; Barunguan Tribe, Stewart River. Fig. 166. Small upper mill-stone; Barunguan Tribe, Stewart River. Fig. 167. Repaired *Nautilus* shell used as drinking vessel; Mutumui Tribe, Cape Melville. Fig. 168. Hafted stone axe; Hileman Tribe, Mona-mona.

position), which has its lower extremity pressed firmly into a notch in the side of a similar wand laid on the ground and held in place with the foot. The twirling sticks are at first often five or six feet in length, but of course gradually become reduced with use. When not in use the ends of the sticks are protected in a sheath or case (as described by Roth); sometimes this case is embellished with a

Fig 169. Crude hand chopper used for opening screw-palm fruits, Bowen, Queensland. ($\frac{7}{16}$ nat. size.)

knob of wax, into which jequirity seeds (*Abrus precatorius*) are fixed. More rarely the sticks themselves have a scratched or carved pattern (fig. 80-81). A man rotating the upright stick places his hands near the top of it, and as it is twirled his palms travel down the shaft. With a quick movement he then brings them up again. During wet weather the process of firemaking is often tedious, and two persons may assist, one quickly continuing the twirling when the other tires. The firesticks are not resorted to unless absolutely necessary, and parties carry smouldering *Eucalyptus* branches with them, even taking them from the islands to the mainland in their canoes, rather than be put to the necessity of generating fresh fire. Crude hand-choppers of stone, really only broken pebbles, are in use for cutting such fruits as that of *Pandanus;* the example shown (fig. 169) was found near Bowen lying in a recently vacated camp, together with a heap of *Pandanus* fruits and some shells which had been used for food. The Charlotte Bay examples are similar, and have been made by breaking a suitable pebble of quartzite so as to secure a cutting edge. The Walmbaria natives use flat grinding-stones for preparing foods, powdering ochre, etc. As mentioned above, a large and very heavy grinding-stone, with deep depressions in the surface, was seen in the Walaeimini rock-shelter at Bathurst Head. At Stewart River the Barunguan people value their stones highly, for there is no available rock in the vicinity—the specimens illustrated were stated to have been obtained

by trade from the Coen district, forty miles away; these mills (fig. 165-166) are used for preparing food and also for grinding ochre for paints. Baler shell is utilized for making dishes as well as for spear-thrower ornaments. Nautilus, trochus, and oyster shell are formed into neck-pendants and other objects of adornment.

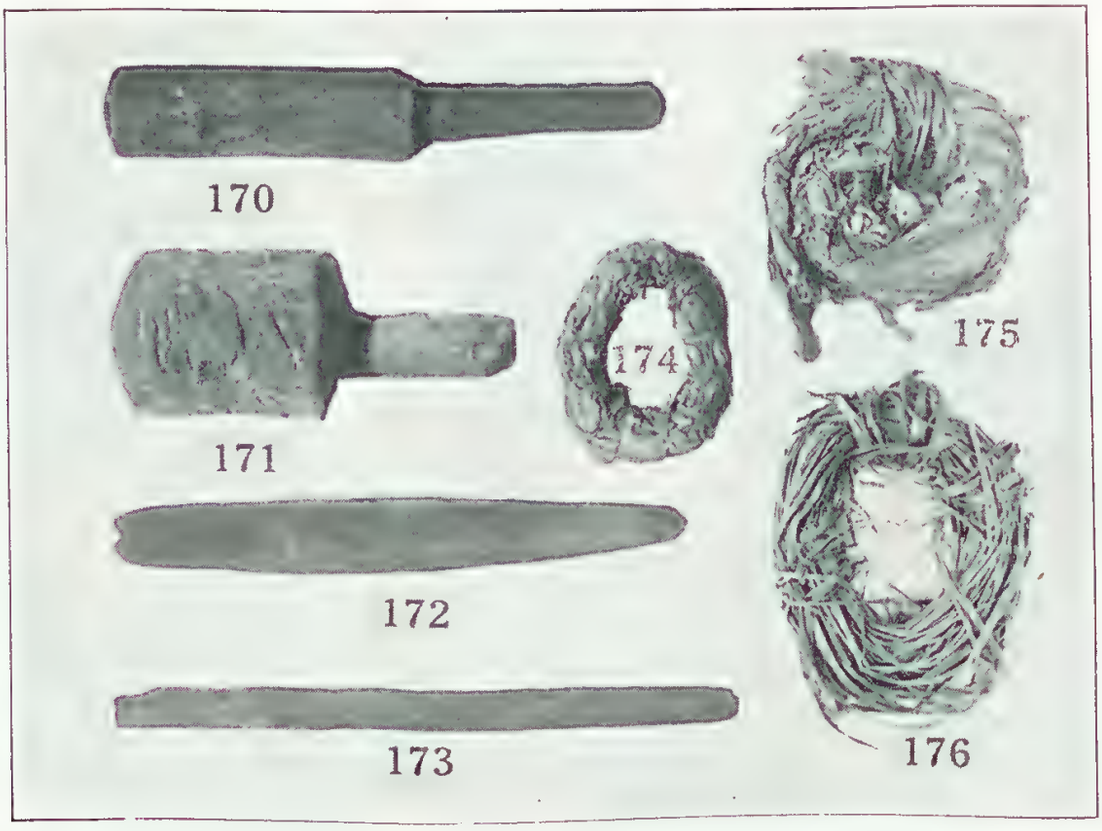

Fig. 170–171. Wooden mallets from Barunguan Tribe, Stewart River, and Walmbaria Tribe, Flinders Island. Fig. 172–173. Wooden implements used by women for digging up water-lily roots; Kokolamalama Tribe, Princess Charlotte Bay. Fig. 174–176. Pads used when carrying heavy objects on the head; 174, paperbark pad, Kokolamalama Tribe, Princess Charlotte Bay; 175–176, paperbark- and grass-pads, Mutumui Tribe, Barrow Point and Cape Melville.

Polished stone axes were formerly in use, but no examples were obtained locally; the large example shown (fig. 168) is from Mona-mona, Queensland, and has a cane handle, but the wax cementing substance is missing from it.

Mallets ('otun'), used by women for pulping various foods and for breaking oysters, are made of iron-wood and other hard timbers. The Walmbaria, Barunguan, and Mutumui tribes commonly use the form shown in fig. 170. This is cylindrical in shape, with one end abruptly narrowed to form the handle, and is very similar in form to the gong-beaters of Melanesian peoples. On Flinders Island and Bathurst Head a much thicker, shorter, and heavier mallet is also made; this may be employed as an anvil as well as a pounder; the example illus-

trated in fig. 171, originally cylindrical, has become suboval in section owing to continued use as a chopping-block. Both types are cut from a single piece of wood. A similar mallet is known also to the Kokowarra people, who call it 'ngawal'.

Short pointed sticks of hardwood for grubbing out water-lily roots (fig. 172-173) and the longer yam stick (of which the sharpened extremity is shown in fig. 77) have already been referred to (pp. 113-114).

Thick ring-pads, which are placed on top of the head when heavy weights are carried are too well-known to need description. We saw them used only by women, who quickly fashion them from either *Melaleuca* bark (fig. 174-175) or grass (fig. 176); they were made by all the Princess Charlotte Bay people encountered.

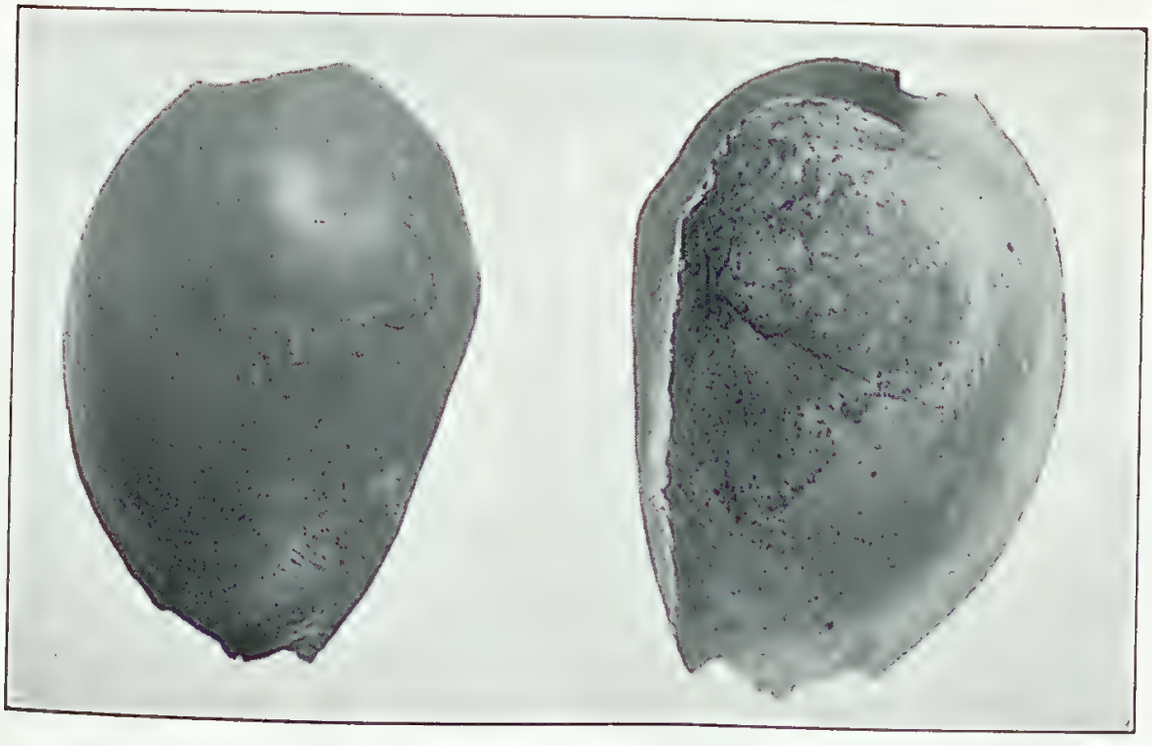

Fig. 177. Baler-shell dish (repaired with resin) which has been used as a cooking pot; Mutumui Tribe, Cape Melville.

Wings of large birds provide fans with which flies and mosquitoes are warded off, and also form brushes with which the tidier members of a camp occasionally sweep out their huts; the wing of a wild goose illustrated (fig. 178) was secured from a Barunguan man who was suffering from large open sores, and was therefore particularly worried by the multitudinous flies and mosquitoes. Smoke fires provide more efficient protection against the hordes of mosquitoes and sand flies, and on a still night many natives were seen carrying a smouldering root or stick

with which to repel the little pests. These insects worry the natives far more than flies, and at times prevent them from sleeping; their abundance may be appreciated when it is stated that in some of the riverine jungle areas the writers experienced difficulty in aiming their guns owing to the obscuring of the sights by the hovering clouds of mosquitoes, which were also attacking all exposed parts of the body.

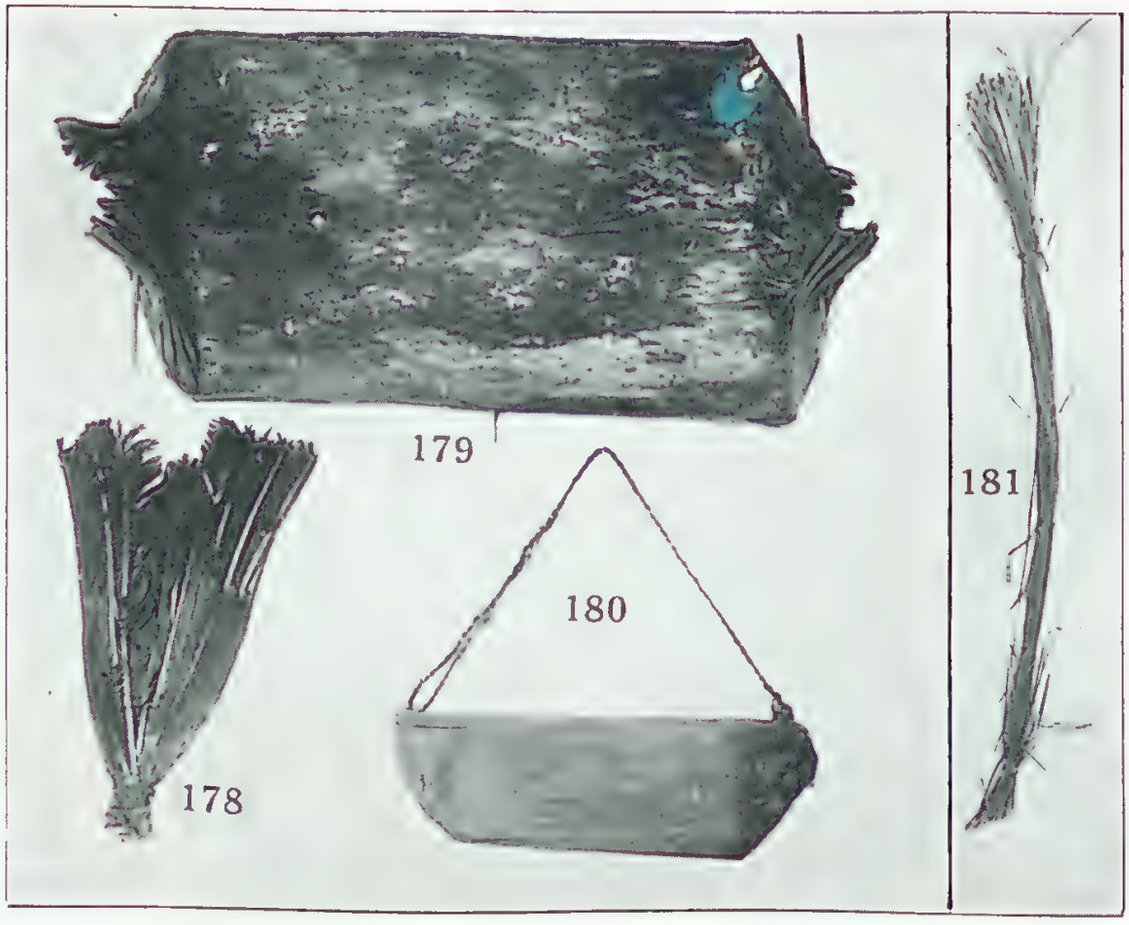

Fig. 178. Wing feathers of goose, used as fly whisk and broom; Barunguan Tribe, Stewart River. Fig. 179. Bark dish; Kokolamalama Tribe, Princess Charlotte Bay. Fig. 180. Palm spathe basket; Barunguan Tribe, Stewart River. Fig. 181. Grass as used for making baskets; from a cave store; Walmbaria Tribe, Stanley Island.

Large baler shells (*Melo diadema*) are used as water vessels, containers for various kinds of foods, etc., and for baling canoes; they are simply prepared by breaking away the ventral surface, the remainder forming an efficient if somewhat fragile basin. These vessels are placed on the fire to boil liquids, and consequently all we saw had the outer surface jet black (fig. 177); if they become cracked with the heat they are repaired with gum. Portions of coconut shells and the shells of the true nautilus (*Nautilus pompilius*) are used as drinking vessels. The last-named are not prepared in any way, but after continued use become

worn and blackened around the lip where soiled by the mouth; when accidentally cracked or perforated they are repaired with gum (fig. 167). Other shells may be used for mixing pigment—for instance, on Bathurst Head we saw one valve of a blacklip oyster being utilized as a "palette" by a man painting on the walls of a rock-shelter.

The Barunguan people make spatulas from the thicker bones of birds and large mammals; these are formed by cutting or grinding the bone to the desired shape (fig. 124-127). The end is smooth, rounded, and spoon-like, and we were told that these implements are utilized to gouge the meat from a species of nut (not the coconut) found at Stewart River and other places. We did not see the bone awls mentioned by Roth ([19]).

Bark vessels of the "pleat-type" were seen in a camp of the Kokolamalama people; they are made of stiff bark, the ends of which are bent up and pleated so as to form a trough. A spike of palmwood is thrust through the pleats to hold them in position (fig. 179). The Walmbaria natives manufacture paper-bark vessels by neatly pleating the ends and tying them around with twine. Palm-spathe baskets are extensively used by the Barunguan people. They are made

Fig. 182. Palm spathe basket used as cradle; Barunguan tribe, Stewart River.

Fig. 183. Method of carrying palm spathe cradle; Barunguan Tribe, Stewart River.

from a single large piece of leaf. The sides and ends are bent up, and then the outer portions of the latter are folded in and stitched through at the top (fig. 180).

Some of the baskets of this type are relegated to the carrying of babies, and are not used for food (fig. 182); in this case the handle is not used, and the basket containing the baby is supported on one shoulder, where it is held in position with

([19]) Roth, North Qld. Ethnography, Bull. vi, 1903, p. 25.

one or both hands (fig. 183). Around the camp women carry their children straddled across the hip, or, in the case of young babies, held against the side, with the hand beneath the child's buttocks and the forearm behind its back; the basket is used when they are travelling long distances.

We selected about 70 dilly bags from amongst those in use by the Princess Charlotte peoples met with, and photographs of a few of these are reproduced in

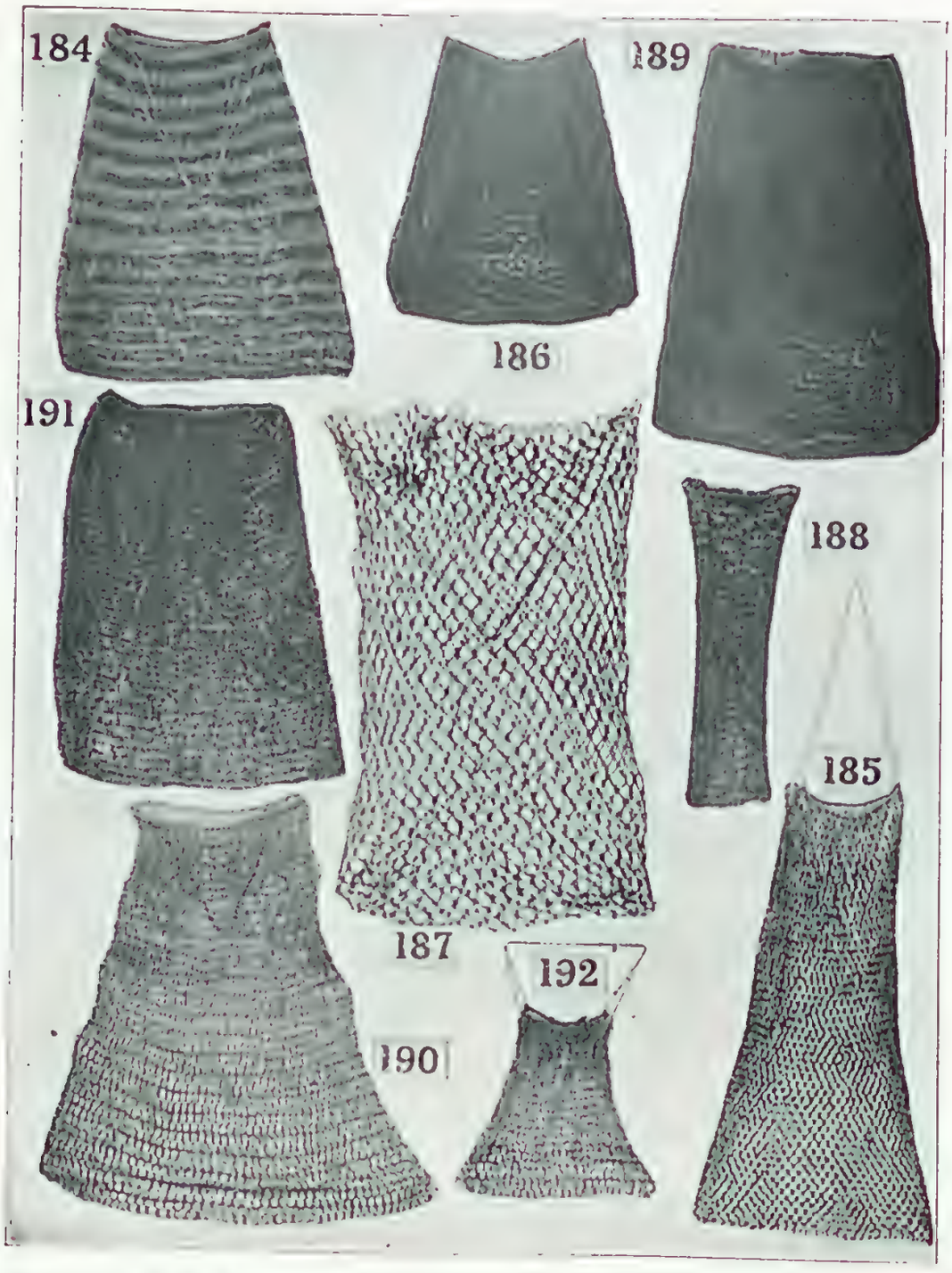

Fig. 184–192. Types of dilly-bags from Princess Charlotte Bay; 185 and 187, are made with knotted technique, the others hourglass; 184–185, Mutumui Tribe, Cape Melville and Barrow Point; 186–188, Barunguan Tribe, Stewart River; 189–190, Walmbaria Tribe, Stanley Island; 191, Walmbaria Tribe, Bathurst Head; 192, Kokolamalama Tribe, Table Hill, Princess Charlotte Bay.

fig. 184-192; the mesh of the nets obtained is mostly the hour-glass or double-loop pattern, although the knotted netting stitch pattern is rather common. The bags are of all sizes, from three inches to two feet in diameter; some are of fine mesh, and used (like certain baskets) as strainers (see p. 115); larger ones are utilized for collecting screw palm nuts and similar foods; others are employed as "carry-alls" for desirable odds and ends. In this last connection it may be interesting to note that the contents of a dilly-bag examined in a Baranguan natives' camp were: three spear-smoothers of hardwood; a sheath studded with jequirity seeds, for the ends of firesticks; prepared wattle-bark and grass for string; wallaby sinews; beeswax and gum; fragments of red ochre; and a small quantity of string made from grass.

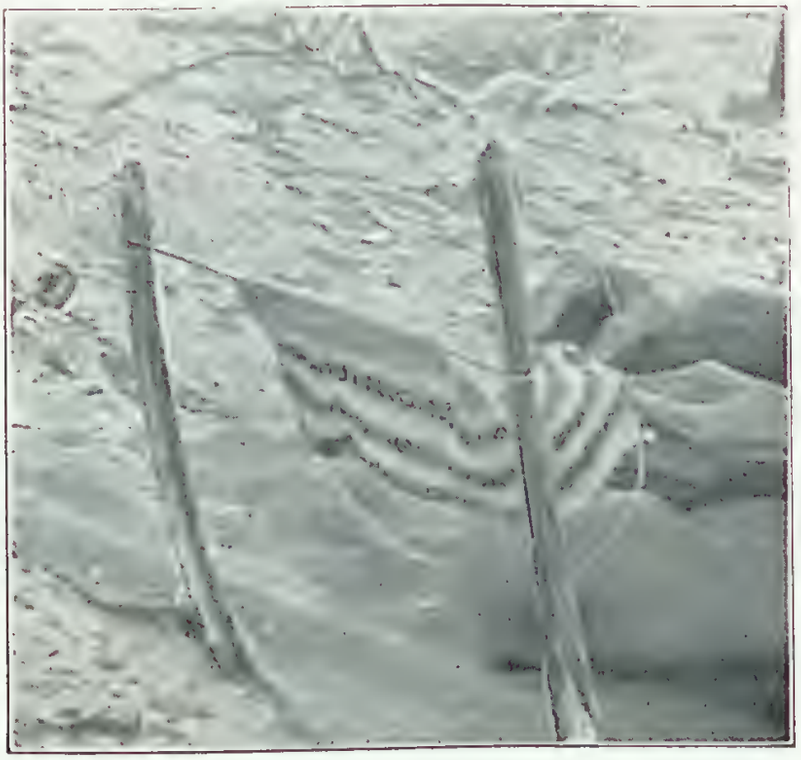

Fig. 193. Method of making dilly-bag with hourglass technique; Walmbaria Tribe, Flinders Island.

Much of the twine for dilly-bags and many other purposes is prepared from the fibres of *Livistona,* as described by Roth ([20]), and the barks of wattles (*Acacia*) are also used. *Acacia* bark is soaked in salt water, and when thus prepared is reddish-brown in colour. String from *Acacia* and *Livistona* are used alternately in some dilly-bags, so that a transverse striped pattern of brown and white is produced. Various other barks are used in the preparation of thicker string, such as that used for large fishing nets and for the mooring ropes of canoes.

([20]) Roth, North Qld. Ethnography, Bull. i, 1901, pp. 9-10, pl. ii, figs. 3-11.

Fig. 193 shows a Flinders Island bag in the making, stretched between the two sticks sloping away from the operator, who is invariably a woman. The bark fibre is kept soaking in water, and about six feet of the two-stranded twine is prepared at a time, the excess being wound loosely around the two sticks during the preparation.

Wallaby tendons, mentioned above, are obtained in the usual way; a small transverse cut is made near the end of the tail, and the portion behind the cut is pulled off, the tendons stripping out with it; when required they are rendered supple by damping and chewing.

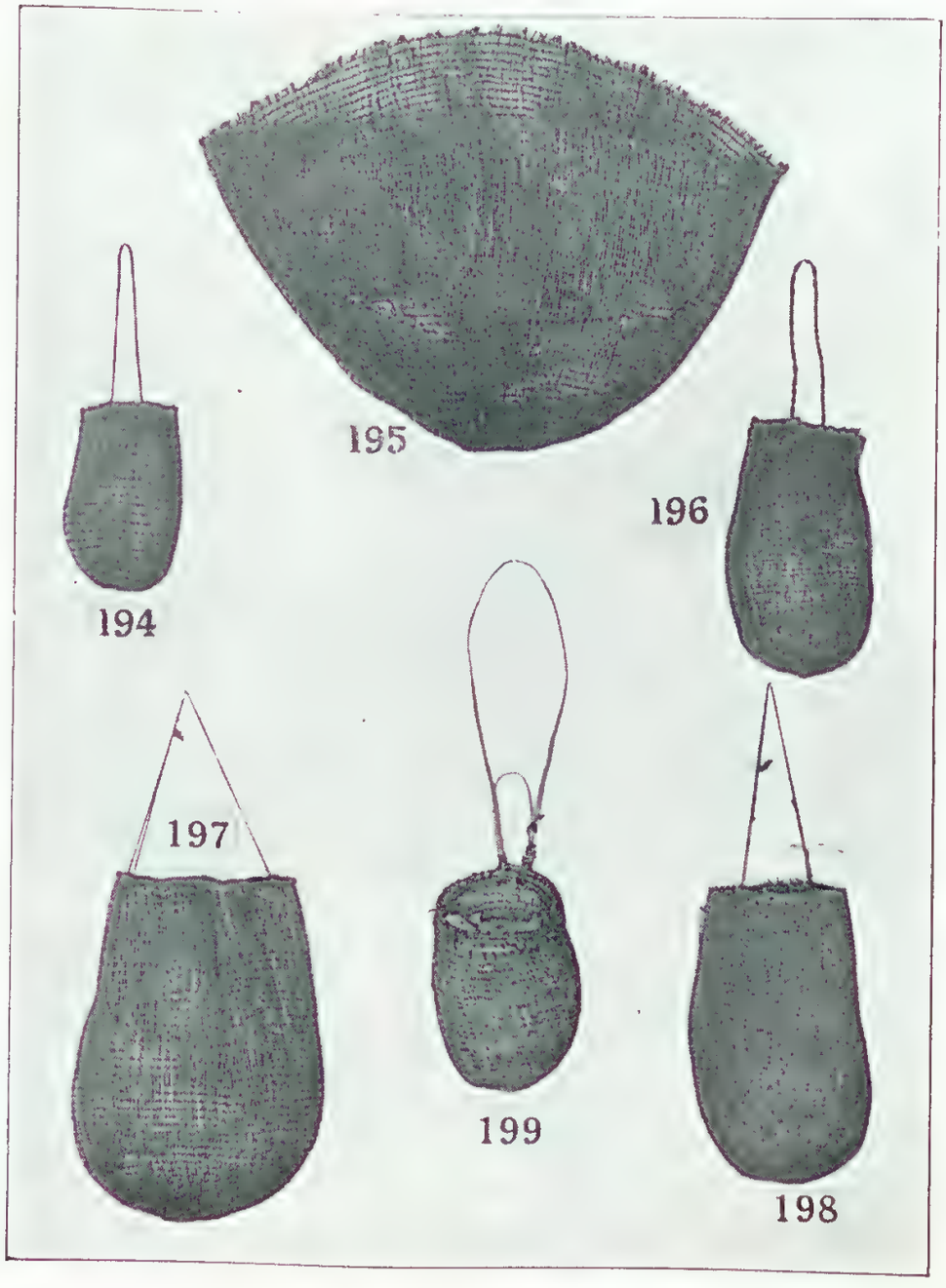

Fig. 194–199. Grass baskets (twined technique); 194–195, Walmbaria Tribe, Flinders Island; 196–198, Barunguan Tribe, Stewart River; 199, Hileman Tribe, Mona-mona.

In the same tribes baskets are made by the twining technique. Two continuous strands of grass fibres are twisted about vertical rigid or flexible bundles of fibre. An elongate cylindrical form with rounded bottom (fig. 194, 196, 197) is manufactured in great numbers, but a type with a very wide mouth is also made; that shown in fig. 195 was obtained from a Walmbaria native. As with the dilly-bags, some of the baskets have handles of string, split cane, or pandanus. The small type (fig. 199), with a forehead strap, both ends of which are fixed to one side of the rim of the basket, is common in the Mona-mona district, on the coast east of Cairns. It is carried on the back, and the longer strap is supported on the forehead.

As pointed out by Davidson ([21]) twined baskets are the most primitive form recognizable, and were made by the extinct Tasmanians.

Among the Walmbaria the raw materials for the manufacture of camp utensils, weapons, etc., and even prized weapons, are stowed away and hidden in crevices of rock-shelters and other suitable situations. A bundle of grass fibre (fig. 181), for baskets, was taken from a store of this material in a small cave on Stanley Island.

CLOTHING AND ORNAMENT.

Contact with Asiatics and Europeans has naturally influenced the dress of the Princess Charlotte Bay people, and when first in the company of strangers some European clothing is worn by most of the younger men and women. Young girls, when not otherwise covered, wear pubic tassels of string, but no clothing is considered necessary for young boys. Old men wear at least a strip of paper-bark or other material depending from a waist-circlet, and covering the genitals. Apart from this many of the old methods of personal adornment are continued.

As mentioned elsewhere in this paper, decoration of the body with paint, scarring, and the knocking out of a front incisor have special significance. These practices and decorative objects, like the bean leg-rattles (which are similar to the goanut rattles figured by Haddon ([22])), used by women during dancing (fig. 200), certainly increase the personal vanity of the individual, and may all be recorded therefore as "ornaments". Certain objects, such as net dresses, hair pendants, compound chain—or rolled—strings, and wooden pendants, worn during mourning and funeral ceremonies, have already been referred to; with such associations the articles are not altogether to be considered ornamental, in fact, they have a rather depressing influence on the wearer, and he discards them after a time so that he will not continue to feel mournful.

([21]) Davidson, Journ. Polynesian Soc., 42, 1933, pp. 257-299.

([22]) Haddon, Anthrop. Exped. to Torres Straits, vi, 1908, p. 312, fig. 70.

The hair (and in men the beard also) is generally kept close-cropped; during mourning periods it is allowed to grow unchecked.

Most of the men and many of the women have the septum of the nose pierced, and wear various kinds of "nose-pegs"; these often consist of a smooth cylindrical piece of wood or bamboo (fig. 46 and 48), and if a peg of this type be at all large it considerably alters the appearance of the face as seen in profile. Several Barunguan men were seen wearing curved nose-pins cut from ribs of the whorls of the *Megalotractus* shell (fig. 201 and 207); some of these were large, seven or eight inches in length, and at a little distance the persons wearing them

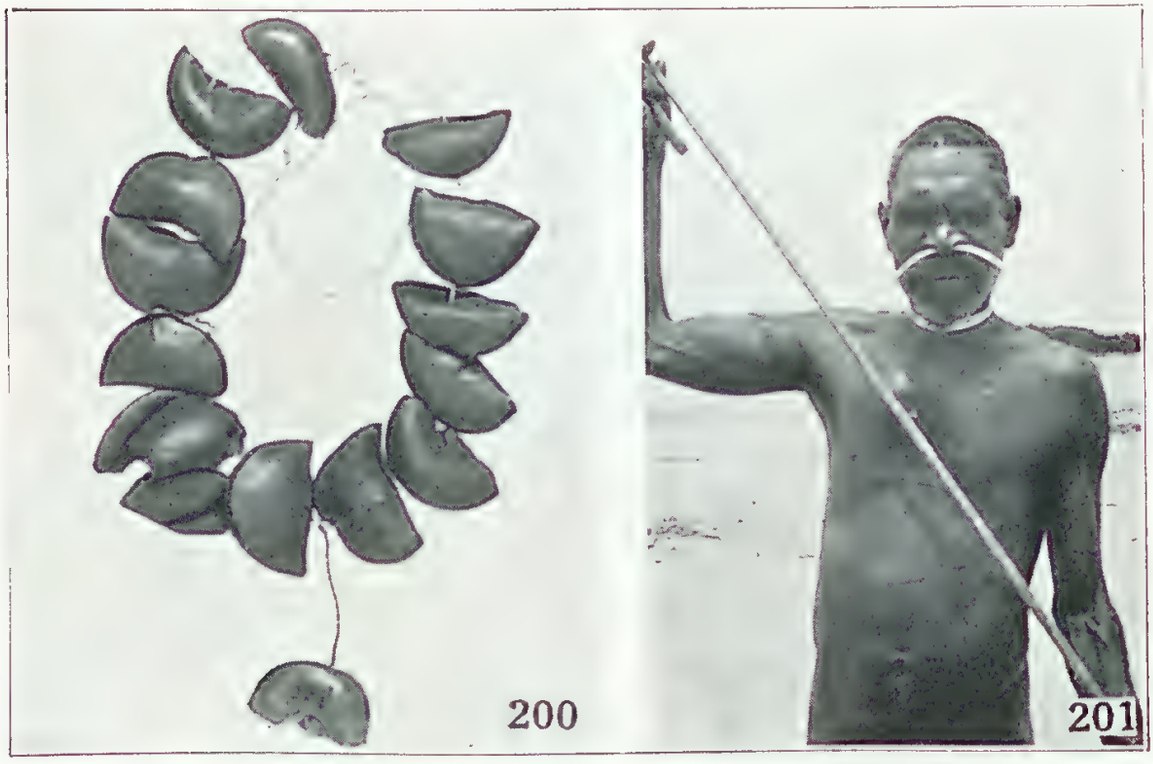

Fig. 200. Woman's leg rattle of halved goanut shells; Walmbaria Tribe, Flinders Island.
Fig. 201. Barunguan men wearing nose ornament made from carina of a shell (*Megalotractus aruanus*), Stewart River (compare fig. 207).

appeared to have long moustaches of the "walrus" type. As far as could be ascertained nose ornaments have no ceremonial significance amongst the Princess Charlotte Bay people, and are worn simply as decorations.

A few of the men had the lobes of the ears pierced and artificially distended, and on occasion thrust through these holes objects similar to those worn in the nose. Small implements and utensils are also occasionally fastened in the ear-lobe, which thus becomes a convenient temporary repository.

Necklaces, particularly those made from *Nautilus* shell, are plentiful. Those seen in the Princess Charlotte Bay districts consisted of small rectangular pieces

of the shell, each piece pierced with a single hole. The shell is strung on two strings of *Livistona* fibre, which are made to pass through the hole from opposite sides, so that the pieces of shell closely overlap. That shown in fig. 202 was made by the Walmbaria, 203 by the Kokolamalama, 204 by the Barunguan, and 205 by the Mutumui tribesmen. These necklaces are worn by women and children, occasionally also by men, but are apparently rarely used as fillets. The example in fig. 203 has a larger ovate piece of *Nautilus* shell at one end of the double string; this pendant hangs at the back of the neck.

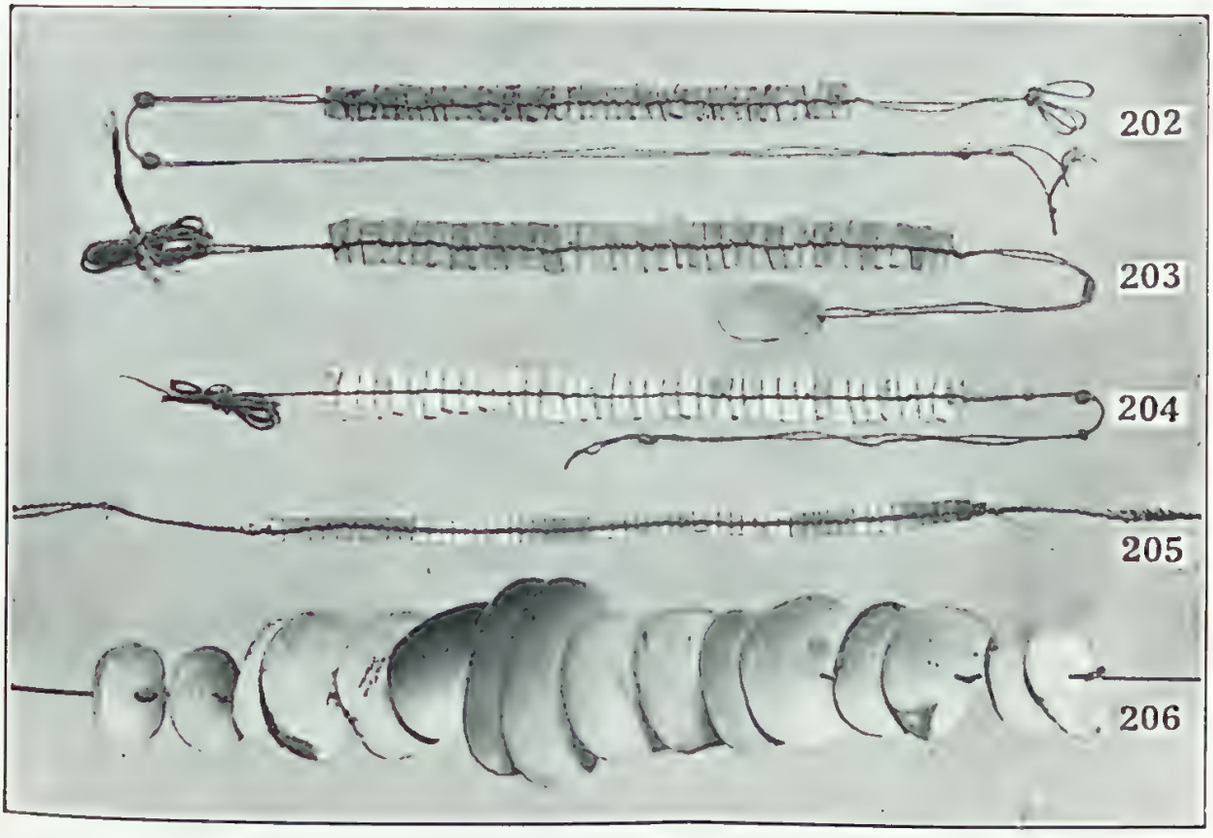

Fig. 202–206. Shell ornaments; 202, Walmbaria Tribe, Flinders Island; 203, Kokolamalama Tribe. Table Hill, Princess Charlotte Bay; 204, Barunguan Tribe, Stewart River; 205, Mutumui Tribe, Barrow Point; 206, Hileman Tribe, Mona-mona.

A necklace formed of rather large, suboval pieces of *Nautilus* shell, each pierced with two holes and strung on a single string, was obtained from Mona-mona (Hileman tribe). This type (fig. 206), according to Roth, may have been bartered from the Carpentaria coast.

Fillets of string or other material are sometimes wound tightly on the head—not as an ornament, but to cure headache.

Grass and reed necklaces (fig. 208-209), which consist of scores of short pieces of the stem strung on a string, are often made. They may be of considerable length, but are not so highly valued as the shell ones.

Portions of *Nautilus* and pearl-oyster shell, ground to an oval or blade-like shape, are pierced at one end, threaded on a string, and hung around the neck; the shell rests on the breast (fig. 210-214). At fig. 215 is an unpierced pearl-shell ornament, while fig. 212 shows a pendant of two pieces of the shell. This last

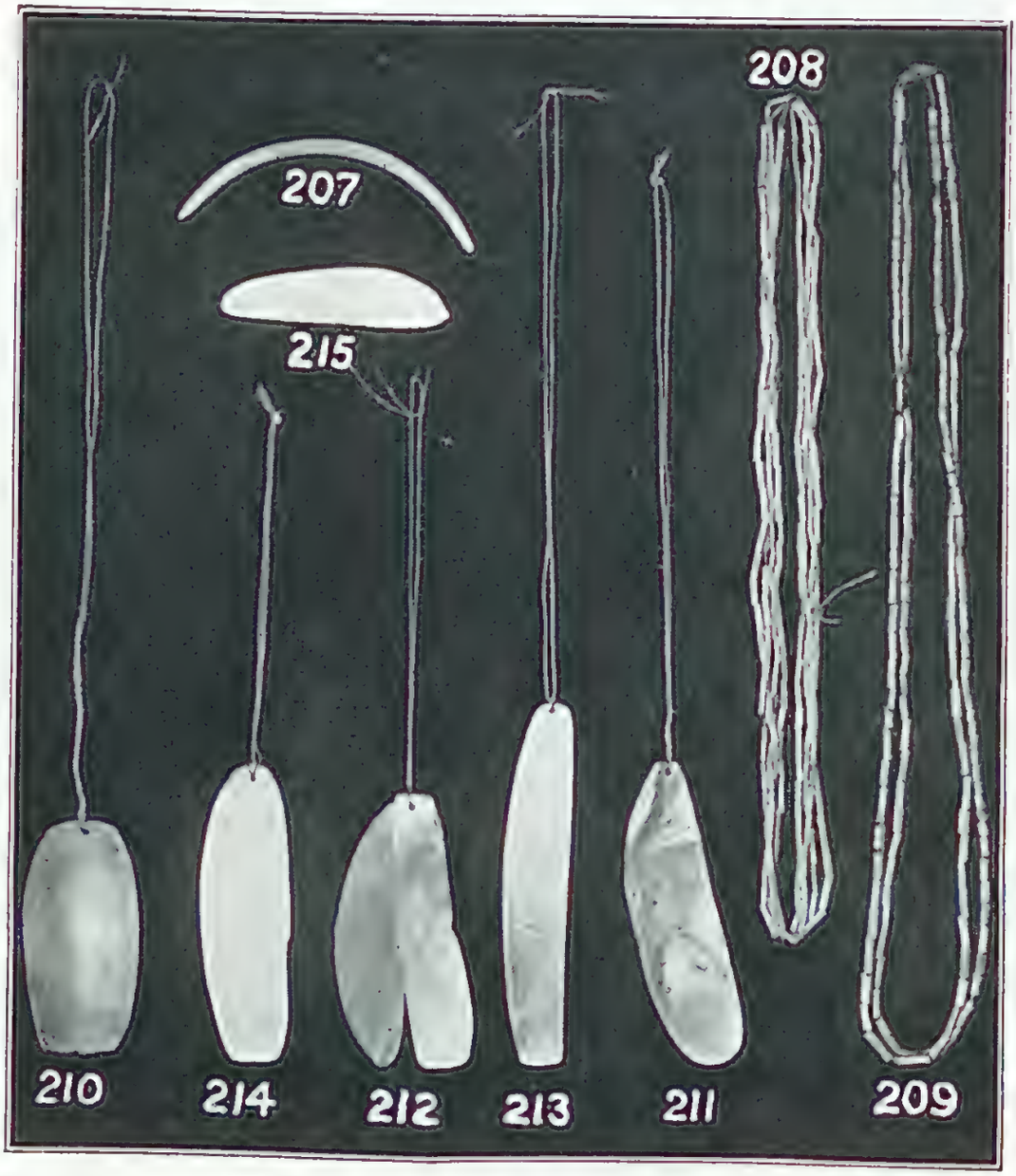

Fig. 207. Shell (*Megalotractus*) nose-pin. Fig. 208–209. Reed necklaces; Walmbaria Tribe, Stanley and Flinders Islands. Fig. 210–15. Shell pendants; 210, *Nautilus* shell, the others pearl shell; 210–211, Walmbaria Tribe, Flinders Island; 212, Walmbaria Tribe, Flinders Island and Bathurst Head; 213, Walmbaria Tribe, Stanley Island; 214, Kokolamalama Tribe, Table Hill, Princess Charlotte Bay; 215, Barunguan Tribe, Stewart River.

example is of interest in that one of the shells was ground on Flinders Island and the other was made at Bathurst Head, on the mainland, and eventually obtained by barter by the Barunguan native who was wearing it. Pearl-shell pendants are more plentiful than any other kind on the coast and are more sought after.

Pandanus armlets (fig. 216-217) are quickly made. A strip of screw palm leaf, twenty inches or so in length and from one to two inches in width, is used;

the method of manufacture is similar to that described by Roth (23) for other tribes, namely, one end of the strip is split into tags, and a corresponding number of slits made near the other end. The leaf is first rolled to the desired diameter, and the tags are passed through the slits and knotted inside the armlet. The

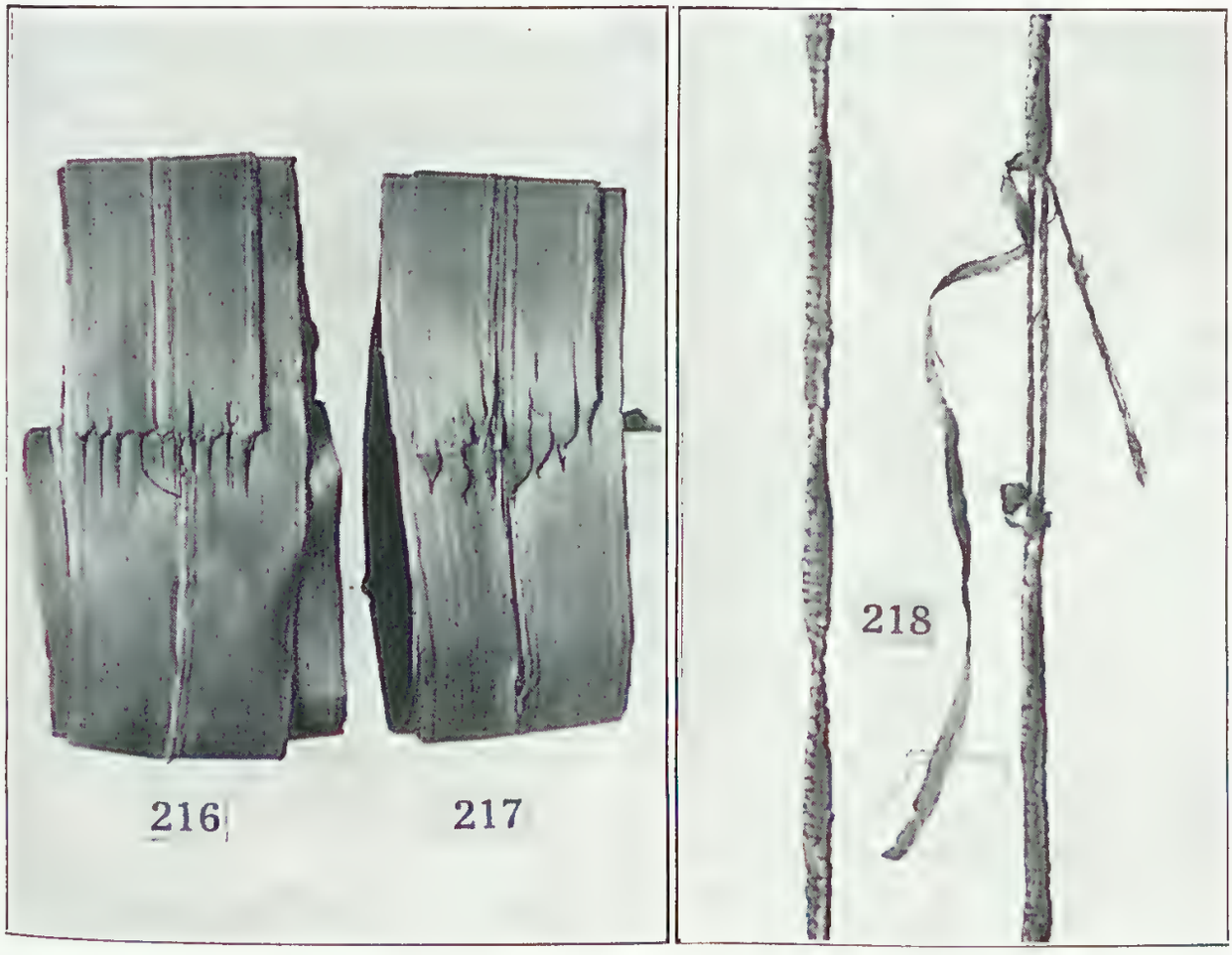

Fig. 216–217. Pandanus leaf armlets; Walmbaria Tribe, Stanley Island. Fig. 218. Portions of a waist belt; Barunguan Tribe, Stewart River.

neatness of the tag and slit join varies considerably. Some of the Walmbaria natives cut one end into from ten to twelve tags, and run a sharp tool across the outer surface of the leaf at the base of the tags, ensuring that the latter easily bend down through the slits in a straight line; others are not so particular, and form an irregular seam with only a few tags pushed through and knotted.

Fig. 218 shows a type of waist-belt, or waist-circlet, which is now apparently rather rare in the tribes encountered; it is only one-eighth of an inch to three-sixteenths of an inch in diameter at the widest part, and is from four to six feet in length. This kind of ornament was secured from the Mutumui and Barunguan

(23) Roth, North Qld. Ethnography, Bull. 1, 1901, p. 11, pl. iv.

people. It is made from a strip of yellow fibre or bark, wound closely around two lengths of two-ply *Livistona* string, and bound with a single ply of the same fibre; the latter is passed over one side of a turn of the cane-strip, then drawn down between the two strings and across the opposite side of the turn. Thus the completed article is yellow with a longitudinal median blackish line of the fibre on each side. In the Mafulu district of Papua a similar yellow fibre, obtainable from a species of orchid found only in the mountains, is an important article of trade with the coastal people.

A single string may be used as a decorative waist belt (and is also used as a ligature to relieve abdominal pains). The natives obtain a certain amount of European cotton material, and in some cases this is adapted to form armlets, belts, etc. A flour-bag may be picked to pieces and the material made into twine for chain mourning-strings, waist-circlets, or armlets. At Flinders Island we discarded a length of cinematograph film; the natives eagerly secured this, and wound pieces of it around the waist as a circlet. The black and red paper backings of our Kodak roll-films were similarly used.

NARCOTICS.

When ample tobacco is available smoking is indulged in to excess until the supply is exhausted or considerably depleted. Even small children smoke, often to such an extent that they become drugged and sick. The practice seems to be a newly acquired one, and appears to have entirely supplanted any earlier forms of narcotics that may have been indulged in.

Tubular smoking-pipes—cylinders with one end closed and with a small lateral hole near the closed end—are still quite common. Bamboo is the usual and preferred material; all the coastal tribes of Princess Charlotte Bay depend upon drift-bamboo for their supply, and as the current which carries this to their shores operates only for a limited period each year these pipes are prized, are used for long periods, and, if necessary, are repaired with wax or gum.

Photographs of a selection of the pipes secured in Princess Charlotte Bay are reproduced in fig. 219-225. At fig. 219 is a large example which belonged to a Walmbaria man; this is three feet six inches in length, and is decorated with alternate bands of red ochre and pipe clay, leaving an unpainted space in the middle. The second and smaller pipe (220) was also the property of a Walmbaria man; this is decorated with a few lozenge-shaped and triangular markings, produced by scraping away the cortex of the bamboo. At 221 is a much-used pipe marked with eight or nine lines cut or scored around its circumference at intervals of about three to five inches; these are not apparent in the figure. The pipe

belonged to Ambatalmini, who was the dominant old man of the Mutumui tribe in 1907. The example at 222 came from the Mack River; it is unusually slender, being two feet two inches in length and only half an inch in diameter inside; and

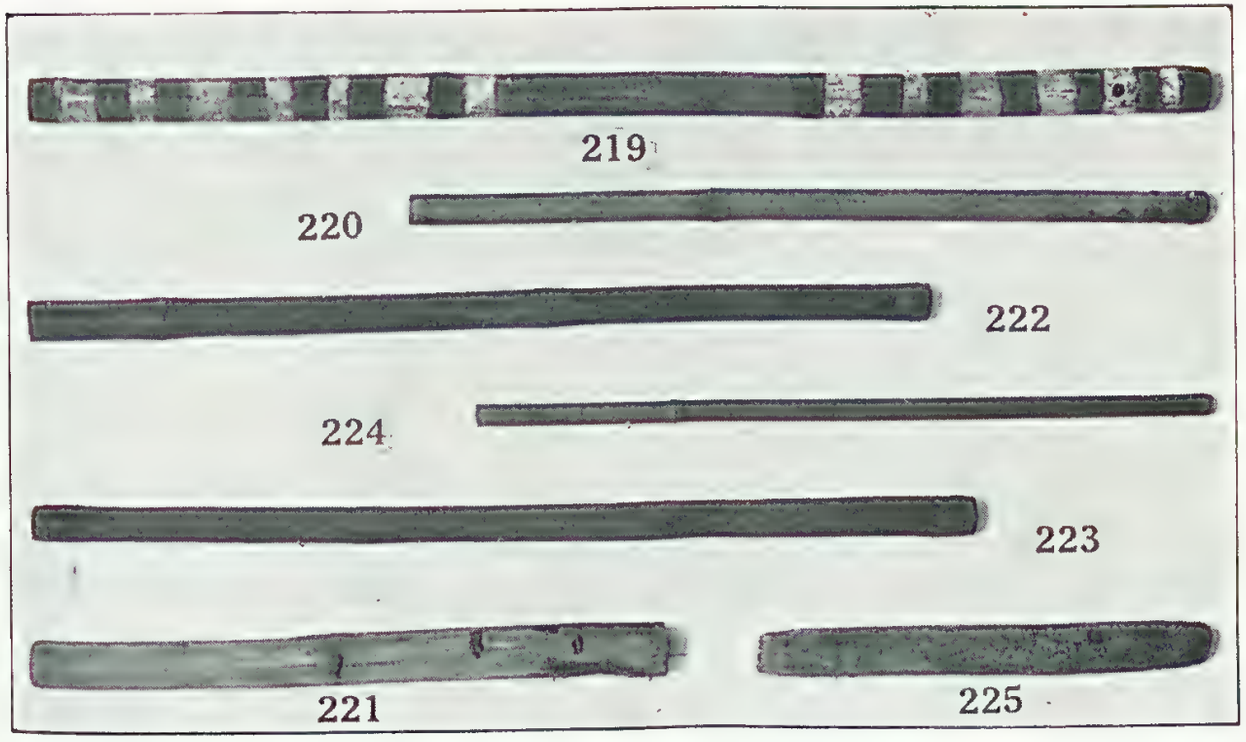

Fig. 219-224. Bamboo tobacco-pipes; 219–221, Walmbaria Tribe, Flinders Island; 222, Mutumui Tribe, Cape Melville; 223, Barunguan Tribe, Stewart River; 224, Mutumui Tribe, Mack River. Fig. 225. Wooden pipe; Kokolamalama Tribe, Table Hill, Princess Charlotte Bay.

shows how bamboo not particularly suited for pipes may be used when no other is available. The old pipe at 223 is from a Barunguan camp; the surface has been worked by skinning off the cortex for one and a half inches from the open end; it is coated with wax to support the mouth, which has split, owing to removal of the outer layer of the bamboo. A Flinders Island pipe, similarly skinned and extensively repaired with gum, is shown at 224. The last example (fig. 225) is an old pipe made from a length of hollow bough; it is only one foot four inches in length, with an inside diameter of one and a quarter inches. One end is blocked with gum, and the small lateral aperture is bored further from the closed end than in any the bamboo pipes examined. This was used by a Kokolamalama man. It has become cracked, and has been repaired with gum.

The manner of using these pipes has been well described; the tube is filled with smoke by a man smoking a European pipe, or a pipe manufactured on those lines, and the smoke is then inhaled by him or his friends, usually through the small lateral hole. With the aid of one of these cylinders a man can inhale his smoke more than once, or can share it with others.

ROCK-PAINTINGS.

The surfaces of large and easily accessible rock-shelters usually bear paintings. Those which it is intended to discuss were selected from large series present in the huge Endaen cave, in the shelter at the Wakarma camp, in the two Worei retreats, and in the Walaeimini shelter. These probably offer a fair sample of the variety and types of designs which occur on the walls and roofs of the wet-weather retreats of the Walmbaria natives. As the pigments are usually dull red, yellow, and black against a brown rock background, and do not lend themselves for good photographic reproduction, our illustrations in the main are sketches of the originals, almost all drawn to scale. Other sketches than the series here presented were made, but have been omitted because we were unable to obtain definite and confirmatory evidence from the natives as to the objects which they are intended to represent.

The Walmbaria natives readily furnished details regarding each of the drawings represented. Some of the figures obviously represent the animals and objects they are intended to depict, but in certain cases the subject is far less evident. Doubtless much depends upon the skill of the individual artist, and doubtless also continual copying and recopying of particular designs by different artists has led to the development of conventional forms.

The native purposely exaggerates certain features in his pictures, particularly those of a phallic nature. The genitalia are often given great prominence in drawings of human figures. The abdomens of moths and butterflies are shown disproportionately large, possibly because the bodies (as distinct from the wings of the insects) are edible, and thus make a stronger impression on the aboriginal mind.

It is doubtful whether (except in a few of the series mentioned below) individual drawings bear any direct relationship to one or more of the adjoining figures—that is to say, in the main each seems to have been an entity; no "picture story" has been attempted. No appreciation of relative size was noted; a porpoise five inches in length was shown alongside a moth covering seven and a half inches by six inches of wall-space, and rubbing shoulders with a man only four inches from head to heel. The pictures may be compared with the drawing of a child, which often bears little resemblance to the actual subject, but which nevertheless conveys to the artist a vivid impression of the object depicted. In many cases the artists have made no attempt to orient their pictures, and on an upright wall space, or on a roof, the figures are drawn in just where they will fit. All drawings on a small portion of the Endaen shelter are shown in the top part of fig. 226 to illustrate this. A few definite series of figures do exist, however, and

a connected set of markings interspersed and overlaid with other drawings is reproduced in fig. 232, showing part of the Walaemini shelter. In most of the shelters the picture are of different ages, some are almost obliterated, and partly erased examples are commonly overlaid by newer pictures. A few are decorative, like the designs on weapons, implements, turtle heads, etc., but unlike the last-named apparently have no utilitarian or symbolical purpose. Walmbaria men described rock-paintings of special and magical significance on Clack Island (see p. 91). Cunningham and another member of one of King's expeditions visited this island in 1821. After describing the geological features, he notes (24) that on the south-east part "there is a horizontal stratum of black schistose rock, which was of so soft a consistence that the weather had excavated several tiers of galleries; upon the roof and sides of which some curious drawings were observed: .... they were executed upon a ground of red ochre .... and were delineated by dots of a white argillaceous earth, which had been worked up into a paste. They represented tolerable figures of sharks, porpoises, turtles, lizards, ... trepang, starfish, clubs, canoes, water-gourds, and some quadrupeds. .... The figures, besides being outlined by the dots, were decorated all over with the same pigment in dotted transverse belts. Tracing a gallery round to windward, it brought me to a commodious cave .... sufficiently large to shelter twenty natives. Many turtles' heads were placed on the shelfs or niches of the excavation. The roof and sides of this snug retreat were also covered with the uncouth figures ....". Roth saw these paintings on Clack Island and illustrated some of them (25).

As is to be expected in coastal shelters, a vast number of the drawings examined by us represent marine creatures. Animals living in the scrub-lands, human figures, and native implements have also received due attention. A few designs are admittedly only decorative, and a number are meaningless to the present-day representatives of the Walmbaria people.

Throughout the reproduced sketches the colours are indicated as follows: White—outline only; red—cross-line shading; yellow—dotted shading; reddish-yellow—dot and line shading combined; black—solid black. In the main the general colour scheme is thus made moderately clear in the line illustrations, although the method has some disadvantages; a few clear interspaces, for instance, may possibly be construed as representing white instead of bare rock.

The Walmbaria people collect pipe-clay for preparing these drawings from a deposit on the southern side of Flinders Island. At least some of their red ochre comes from Starke River, whence it is obtained by trading.

(24) King, Survey Coast Aust., ii, 1827, pp. 26-27.

(25) Roth, Aust. Assoc. Adv. Science, ix, 1902, pp. 493-495, pl. xiv.

Endaen Shelter.

All drawings on a five-foot strip of the wall of this shelter are shown above the dotted line in fig. 226; the remaining sketches are selected from our notes, and occur on different parts of the shelter.

The paintings in this retreat are the work of the Stanley Island group of the Walmbaria tribe; some of them have been executed during the last twenty years, but the origin of others is not known to any of the present inhabitants (see *d*). As usual, they are of two general types; in one an object is simply outlined in colour or filled in solidly with one colour, but in the other a more ornate effect is produced by margining or banding the figure with different colour. *h*, *i*, *j*, *p*, *q*, *r*, *s*, and *w* may be taken as examples of monochrome figures, while more ambition has been evidenced in the execution of most of the others, two colours having been used.

Some of the figures (for instance, the turtles, dugong, cassowary, frog, and most of the fish) are fairly obvious representations of the animals concerned. One of the most simply drawn, or conventionalized, of the paintings is that of a flying-fish (*p*); this consists of seven yellow strokes each the width of a finger.

When questioned about the figure *e* (which appears with variations in several coastal shelters) the natives brought us a smooth, pink Holothurian which this drawing is supposed to represent. The common blackfish, another Holothurian which was abundant, was shown to them, but they stated that this was not the subject—'tandi', the paler sea-slug, was the one depicted. The amorphous mass at one end represents the filamentous Cuvierian organs which a few species eject when alarmed.

The human figure at *a* has the head pointing to the right; the legs are shown in a squatting position, and between them is a large pair of testicles. A grotesque dancing man (*t*) is drawn around a cavity in the rock; other cavities (see *u* and *v*) have colour patterns around them, in some cases merely a decorative effect being aimed at. The small fish called 'morun', shown in *g*, lives in the mangrove-swamps, but we were unable to ascertain the species; it is not the abundant mud-skipper (*Euchoristopus kalolo*) of the vicinity. Other designs consist of the familiar circle-patterns, double-headed figures, men, etc. Photographs of part of the roof and a small portion of the lower part of one wall are reproduced in fig. 161. The last-named shows a mother with her newly born baby, with the umbilical cord connected; in this picture may be seen a large square block of stone on which pigments are ground. Other drawings, including a recently executed one of a trepang cutter, are indistinctly shown on the wall above some turtle-heads (fig. 159).

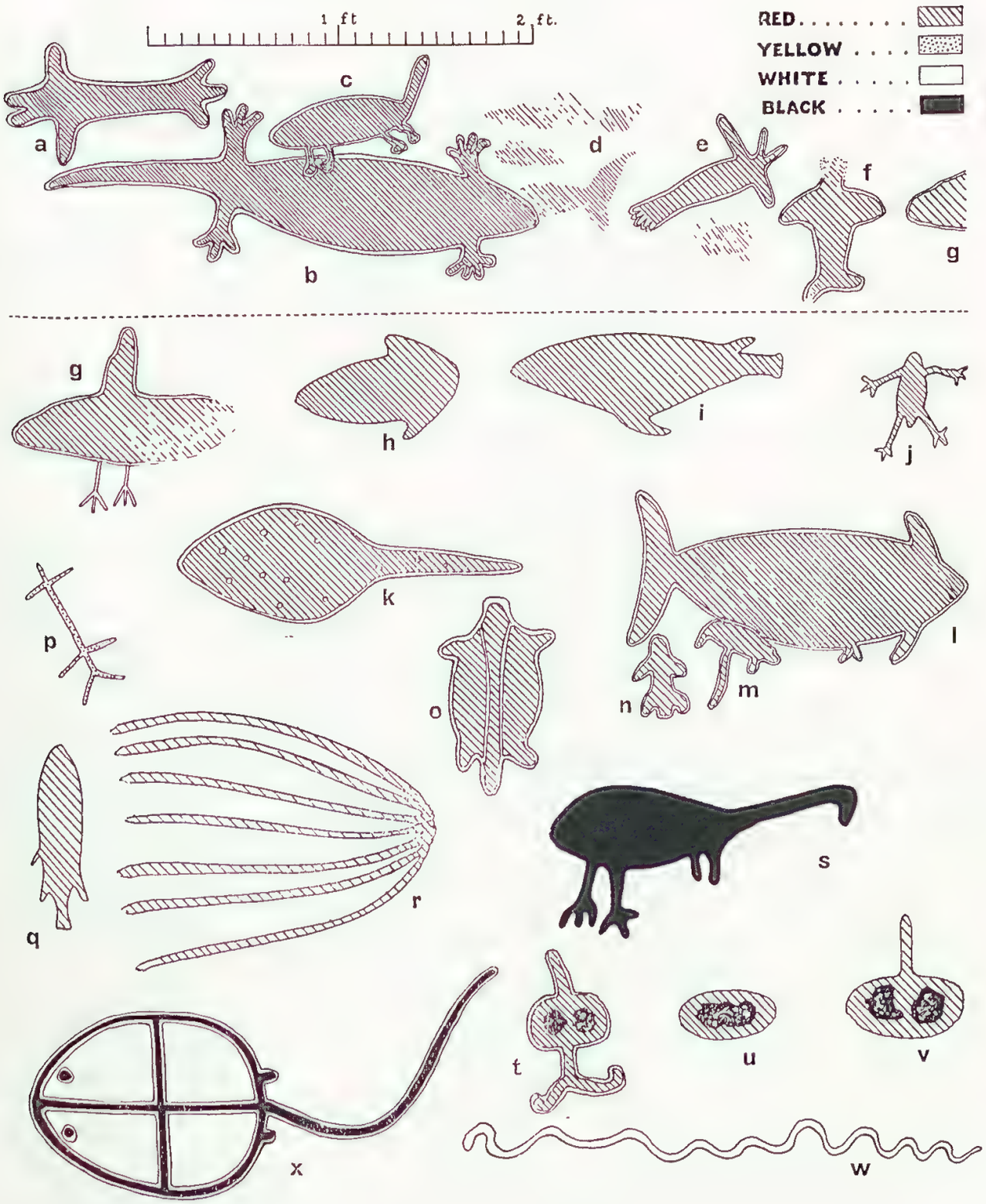

Fig. 226. Rock paintings in Endaen shelter; Walmbaria Tribe, Stanley Island; *a*, man (beangai); *b*, goana; *c*, fresh-water turtle; *d*, partly obliterated old paintings; *e*, holothurian (tandi); *f*, devil ray or diamond fish (toal); *g*, curlew (urultural); *h*, cassowary track; *i*, a fish—*Cantherines*—(wongani); *j*, frog (tarai); *k*, shovel-nosed ray (atawul); *l*, female dugong (muntoworo); *m*, dog puppy with umbilical cord; *n*, advanced human foetus; *o*, turtle; *p*, flying fish (yindyerta); *q*, small fish (morun); *r*, jelly fish (olel); *s*, cassowary; *t*, dancing man; *u–v*, decorative patterns; *w*, carpet snake; *x*, long-tailed stingray (tombiembiu). *o*, *s*, and *w* are not drawn to the scale indicated.

Wakarma Shelter.

The pictographs in this small retreat are chiefly depicted in red, and the artists seem to have had a predilection for "double-headed" human figures, described to us simply as "men"; their double heads may possibly be intended to

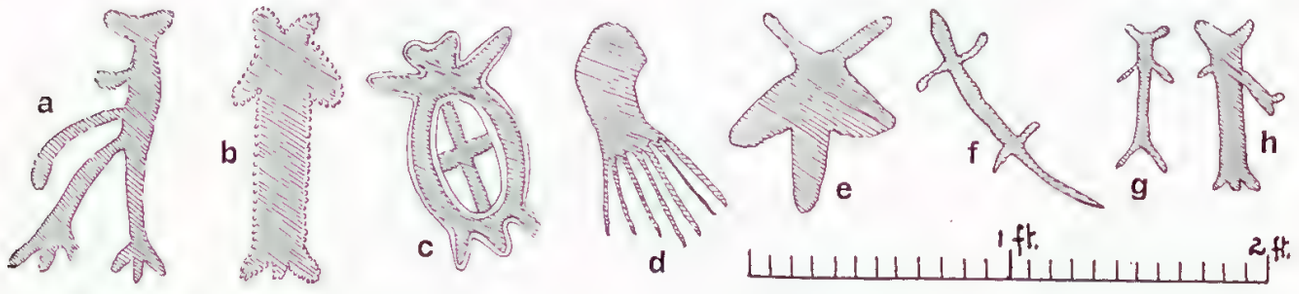

Fig. 227. Rock paintings in Wakarma shelter; Walmbaria Tribe, Bathurst Head; *a*, *b*, *g*, *h*, human figures; *c*, turtle; *d*, octopus; *e*, moth; *f*, rock lizard.

represent ceremonial head-dresses; there are about ten of these figures in different parts of the shelter. A few selected illustrations are shown in fig. 227. The painting at *a* is that of a walking man with a very large penis.

East Worei Shelter.

There are a number of paintings on the smoke-blackened roof of this retreat, most of them being under a foot in length; they are drawn in white pipe-clay and red ochre. A few representative designs are shown in fig. 228.

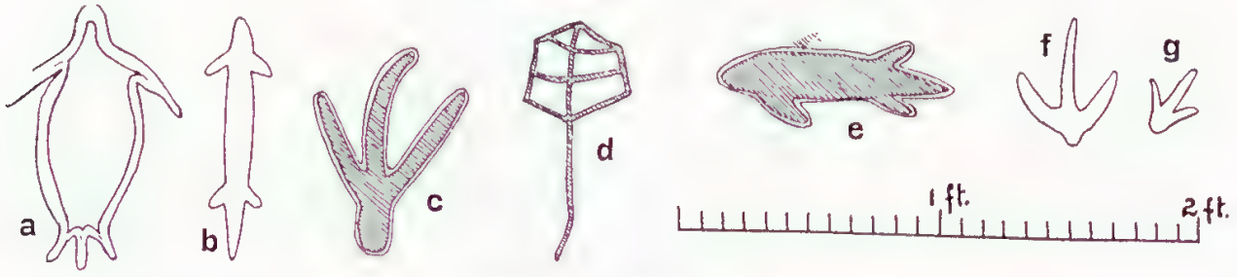

Fig. 228. Rock paintings in East Worei shelter; Walmbaria Tribe, Bathurst Head; *a*, turtle; *b*, crocodile; *c*, *f*, *g*, emu tracks; *d*, stingray; *e*, dugong.

The emu-tracks, *c*, *f*, and *g*, are of very different sizes. The drawing of the stingray (*d*) has a strange appearance, and differs a great deal from one of the other drawings of this fish on Stanley Island (fig. 226, *x*). Several other drawings are fairly well defined, and there are traces of many almost obliterated figures. One of the most recent represents a trepang cutter, a type of vessel which has only become common along the coast within the last three decades.

West Worei Shelter.

On the high wall face of this shelter are many very old and faded outlines of large size. The pictographs which are clearly traceable are shown in fig. 229. These designs convey no special meaning to the present-day natives; the figure on the left appears to be that of a quadruped.

Fig. 229. Ancient paintings in West Worei shelter; Walmbaria Tribe, Bathurst Head.

Walaeimini Shelter.

Owing to the rugged nature of the rock-surface, few smooth spaces of large area are available in this shelter, and consequently most of the hundreds of drawings on the walls and roof are of a foot or less in length (fig. 230-231). As in the Endaen shelter red ochre and pipe-clay are the main pigments used; an occasional figure is depicted in yellow ochre. In the main the figures are solid red, or are broadly outlined in red; in many the red designs are margined with white lines or with a series of approximated white dots applied with a finger tip; some of the figures are stippled all over the solid ground-colour with white dots. Some of the drawings appear to be rather older than the others, but no definite break in technique or design could be discerned.

A ten-foot strip of the back and roof near the northern end of the low cave is shown in fig. 232. Owing to the length it has been necessary to divide this into two parts, placing the right-hand portion below the left part. On the lower part of this wall is a long line of upright markings (some of which are enclosed in a semi-circle) and a trident-like figure, obviously forming a connected series; the natives did not know the meaning of these old designs, some of which are shown also in fig. 231. Above and around them are paintings of more recent origin and remains of even older figures. On the roof are two butterflies, not distinguished

by the natives from moths (*a*) and a flying-fish (*b*); much more effort has been expended in the last-named than in the simpler delineation of the same subject in the Endaen shelter (compare fig. 226, *p*).

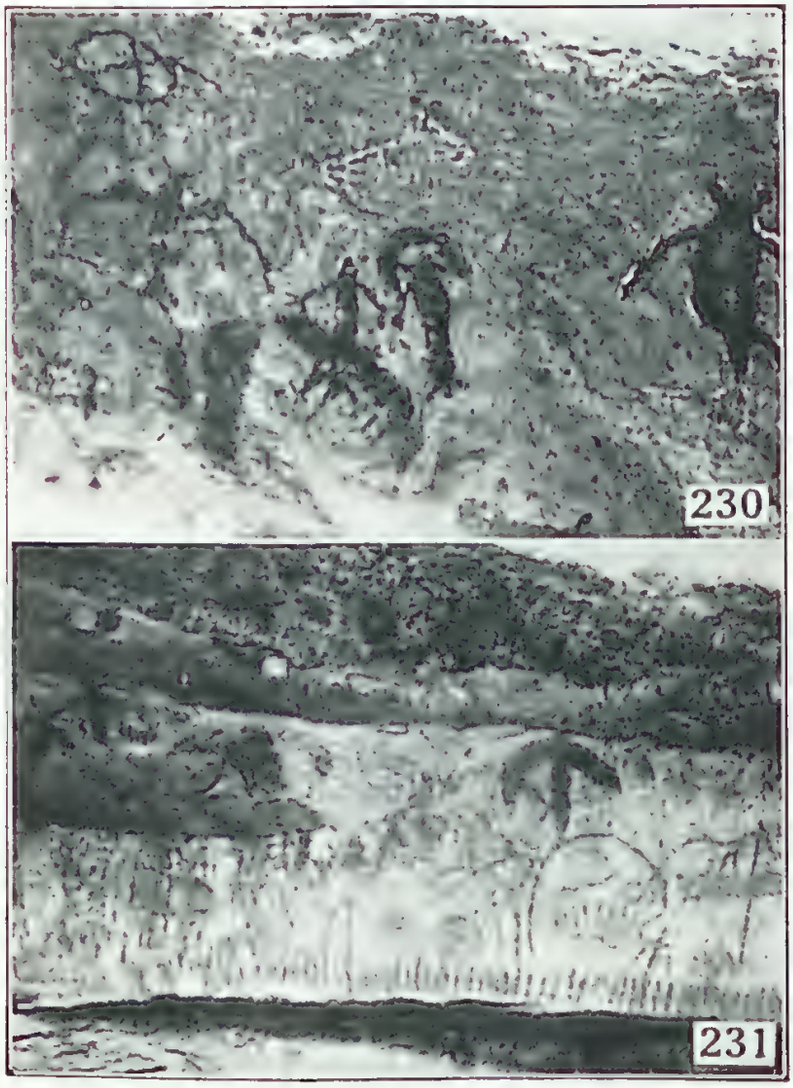

Fig. 230–231. Paintings in the Walaeimini shelter; Walmbaria Tribe, Bathurst Head.

A well-drawn honey-bee appears on the back of the cave (*c*); this is executed in yellow ochre, outlined and banded with red. Amongst other designs are representations of a devil ray or diamond-fish (*d*), a dugong (*e*), a spear-thrower (*f*), and two human hands (*g* and *h*); the hands are not of the usual stencil type, but are "free-hand" drawings. The drawing of the devil ray is of interest when compared with the figure of the same fish in the Endaen shelter (fig. 226, *f*), for it shows how variable may be the rendering of similar subjects by different artists.

The sketches reproduced in fig. 233 represent paintings which occur on different parts of the roof and back, near and at the south-eastern end of the shelter.

Several kinds of pictures are very common in this part of the shelter, particularly small human figures, lizards, stencilled hands, and moths. The lizard (*a*) is blocked in with red ochre, is surrounded with a margin of white finger-stipple dots, and has several bars of similar dots across the tail. In three of the human figures the genitals are given great prominence. The testicles of one man (*b*) are

Fig. 232. Two portions of wall of Walaeimini shelter; Walmbaria Tribe, Bathurst Head; *a*, moths; *b*, flying fish; *c*, bee; *d*, devil ray or diamond fish; *e*, dugong; *f*, spearthrower; *g* and *h*, human hands.

disproportionately large, while the picture at (*m*) was said to represent a little woman with a big vulva; alongside the last is a man with an enormous penis. The frigate-bird is as simply drawn as the flying-fish previously mentioned (fig. 226, *p*), and consists practically of three broad finger-strokes; nevertheless, the

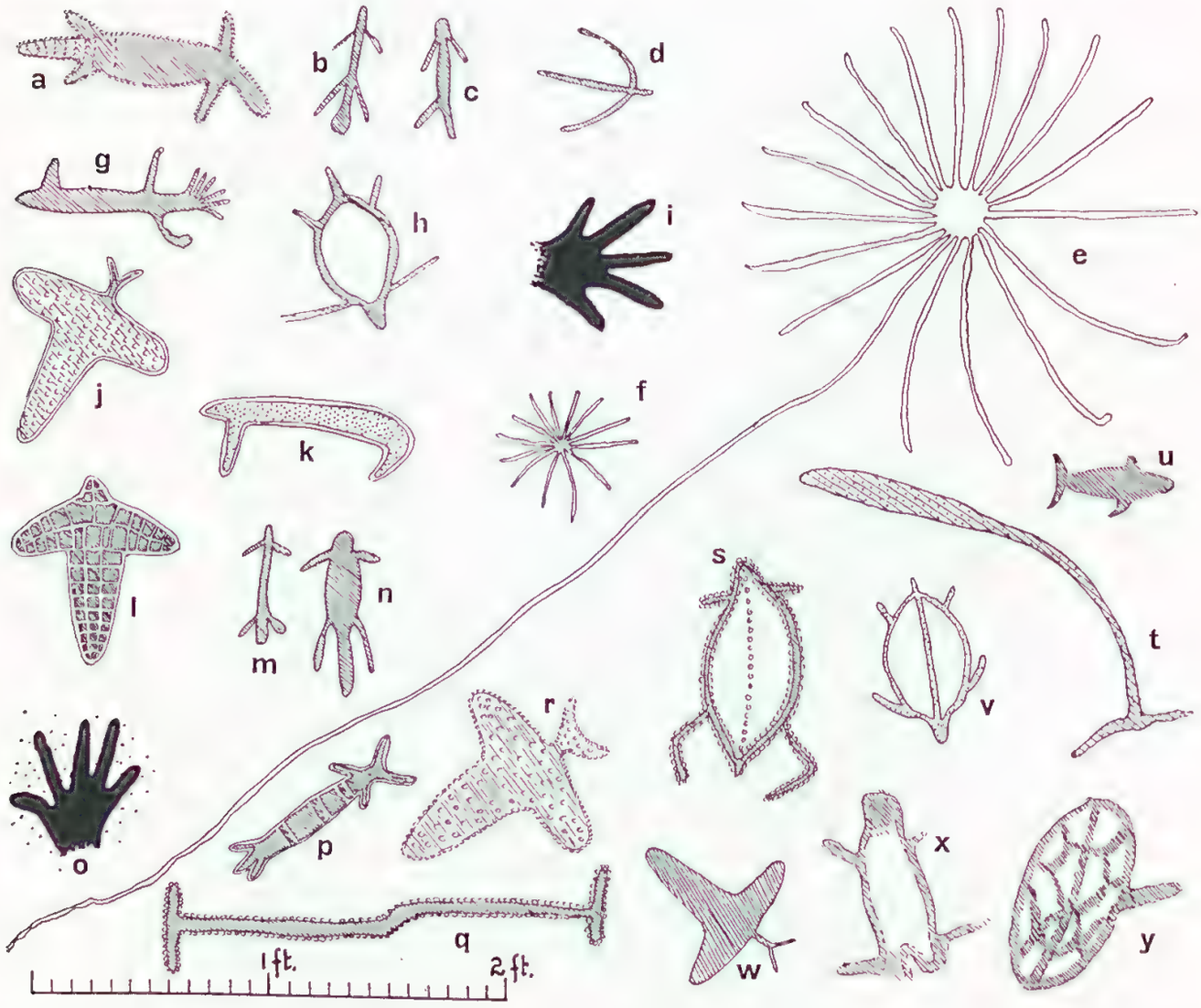

Fig. 233. Selected paintings in Walaeimini shelter; Walmbaria Tribe, Bathurst Head; *a*, lizard; *b*, *c*, and *n*, men (beangai); *d*, frigate bird (oroti); *e* and *f*, star fishes; *g*, Cephalopod; *h* and *v*, turtles; *i* and *o*, human hands; *j*, *l*, *r*, and *w*, butterflies and moths (motjala); *k*, spear-thrower; *m*, woman (ngumbul); *p*, fresh-water crayfish; *q*, yam; *s*, frog (tarai); *t*, unrecognized; *u*, porpoise; *x*, kangaroo, partly obliterated; *y*, (toanam).

long body and tail, and the spreading wings are rather well suggested. A long line emanates from one of the star-fishes on the roof (*e*), and this is supposed to indicate the track. We have already mentioned that in drawings of butterflies and moths the size of the abdomen is greatly exaggerated. A marked feature of pictures of invertebrates having antennae is that the cephalon and its appendages are drawn either as a Y or as a short stalk carrying a crescent, the arms of the last-named, or the fork of the Y, representing the antennae. This is evidenced in *j*, *l*, *p*, and *w*, showing fresh-water crayfish and moths. It is interesting to note

that the body somites of the crayfish are suggested—inaccurately, it is true—by narrow white bars, but the less obvious segmentation of the abdomen of the Lepidoptera is rarely indicated. 'Motjala' (moths and butterflies) are depicted again and again in this shelter, white, yellow, and red being used in various combinations.

We did not learn with certainty what object is represented by the figure at *y*, but were consistently told that it was 'toanam'. Curiously enough this is the name of the food-pounder on Forsyth and Mornington Islands.

One is naturally somewhat surprised to see a spear-thrower drawn in such a crude manner as in the painting at *k*. While the artist who made this drawing was probably quite competent to produce a smooth, shapely weapon, he apparently took little pains to record his handiwork pictorially. The peg against which the spear fits is grossly disproportionate and the baler-shell grip is ill-drawn. We watched a man painting a red hand similar to those at *i* and *o*, and the laborious manner of the task astonished us. The native obtained a palm frond, and chewed one end until it frayed sufficiently to form a crude brush (fig. 235). After mixing pipe-clay and water to a paste (with an oyster shell as palette) he spread his hand flat against a rock-face, and carefully drew an outline around the hand and digits, and then, removing his hand, filled in the outline solidly with red.

Many of the paintings are executed with a forefinger dipped in the pigment, while, as mentioned, stippling is produced with the tip of this digit. The natives are as absorbed as children during this recreation.

Other Forms of Decorative Art.

Pigment is of course applied to decoratively colour objects other than the walls of rock-shelters, but usually for different reasons. Occasionally a painting depicting some definite object or other is drawn on a piece of turtle bone, or some other convenient "canvas", but more usually the decoration in no manner resembles the cave pictures. Fig. 234 shows portion of a turtle bone on which is drawn, in red, white, and black, the figure of a man. This was discovered in a crevice of the Endaen shelter. It is reminiscent of some styles of drawings made by natives of Torres Straits and Papua.

Apart from decorations pure and simple the designs painted on implements and other objects are in the main (a) marks of ownership or tradesmanship, (b) symbolical, in connection with ceremony and magic. Mention of such forms of art are scattered through the pages of this report in the descriptions of the various aboriginal objects, but as examples of the two main types may be mentioned (a) the patterns on spears and other weapons, (b) the painting of the turtle-heads by the young initiate at Stanley Island, and for magical reasons at Clack Island, the

decoration of "rain-makers", mourning tablets and staves, and the ornamentation of the body with ochres and pipe-clay for various ceremonies and dances.

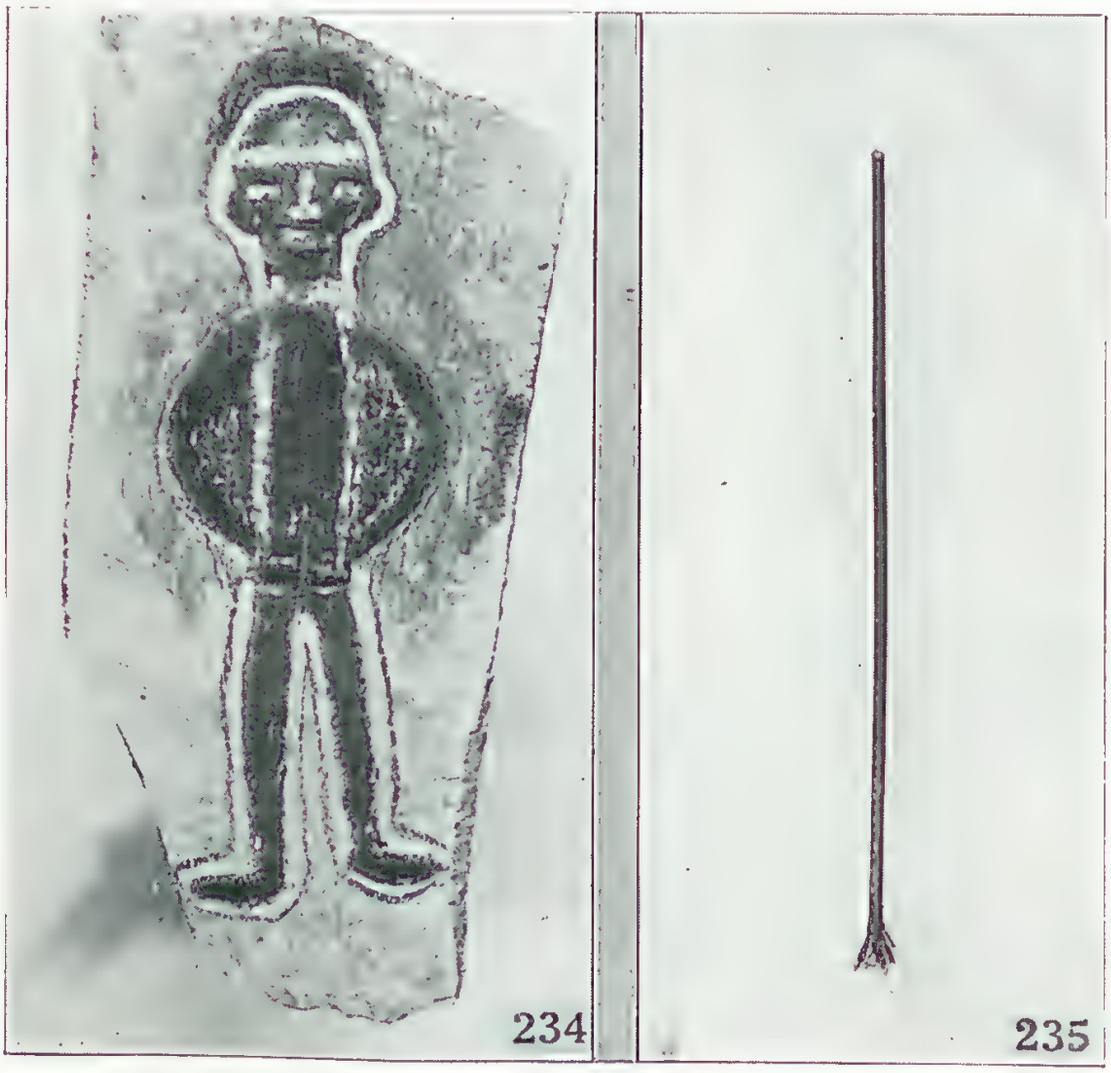

Fig. 234. Painting of human figure on turtle bone; Walmbaria Tribe, Stanley Island.
Fig. 235. Palm-frond paint brush; Barunguan Tribe, Stewart River.

MESSAGE STICKS.

While trading for old bags and baskets at Stewart River numbers of message sticks were noted among the contents of some baskets which were being emptied for our inspection. This led to our being able to secure a series of these interesting objects; some of them were of recent date, others were old. In no case was there any attempt made to indicate a message by symbols on the stick; the communication passed verbally with the piece of wood.

The makers of the various sticks were known by peculiarities in style of workmanship; thus these objects were evidences of good faith, giving authority to the verbal communication. They may also have had some slight mnemonic value.

Mention has already been made of the message stick forwarded by a Mutumui

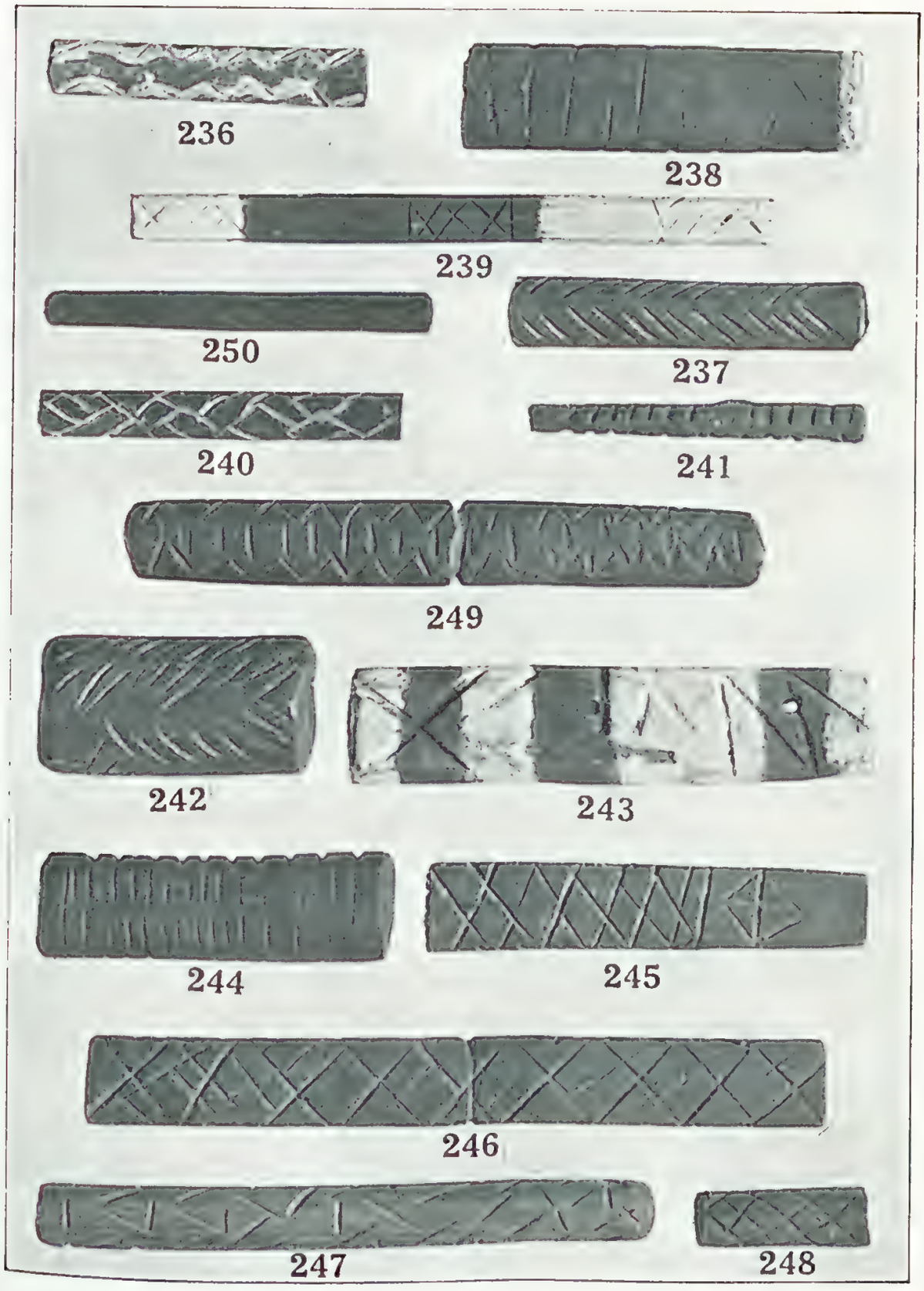

Fig. 236–250. Message Sticks; 236–237, Walmbaria Tribe, Flinders Island; 238–248, Barunguan Tribe, Stewart River; 249, Mutumui Tribe, Barrow Point. Fig. 250. Hardwood peg for spearthrower; Barunguan Tribe, Stewart River.

woman at Flinders Island to her former husband, who was camped inland from Stewart River. This stick was passed on with a verbal message asking that their two children should receive names. Fig. 249 is an example which had passed between them on a former occasion and had been retained by her.

After messages have been delivered the sticks are usually retained for a long period, being either stowed in string bags or tucked away among the leafy coverings of the huts.

When interest was expressed by us, more than a hundred old ones were produced for inspection within a few moments; only in a proportion of the cases could the message be recalled. The verbal messages related to the sending of parcels of spears; arrangements regarding the cutting of canoe trees on the Normanby River in exchange for spears; promises to meet at specified places, either after the elapse of so many moons, at the time when some fruit was ripe, or when certain flowers of seasonal nature were blooming. Fig. 236 and 237 show message sticks which were in the possession of Walmbaria people. Fig. 238-248 have been selected from a long series of old ones without associated messages which were obtained at Stewart River (Barunguan tribe).

Fig. 250 represents an uncarved piece of hardwood such as is frequently carried among a man's personal effects. It can be adapted either as the peg of a spear-thrower or as a message stick.

LANGUAGE.

Opportunity was taken to record comparative vocabularies of several of the principal languages and dialects, but the general nature of our observations unfortunately prevented the recording of texts which would have given data as to the structure of the languages.

The vocabularies were recorded in conformation with the Royal Geographical Society's scheme as detailed in Notes and Queries ([26]), and it has been thought undesirable after this lapse of time to transcribe them into any other phonetic system. Unless otherwise indicated the ng sound is hard as in *finger*, not soft as in *singer*. A stress accent is placed at the beginning of the emphasized syllable.

An approximation to the normal pronunciation of the word has been aimed at. There is considerable variation even in simple words. Thus one would not be incorrect in transcribing Entjinga, the name for the mouth of the Stewart River, as *enjinga, enjunga, yinjinga, yenjinga, yentjinga, yentjunga,* or *yintjinga,* for variations which approximate to these renderings may occur among the natives of the district.

Many of the Kokolamalama people talk rather indistinctly, with markedly

([26]) Notes and Queries on Anthropology, London, 4th. ed., 1912, p. 186 et seq.

aberrant aspirated 'd' and 'w', strongly voiced 'th' and 's' and 'f' sounds which are absent in their neighbours' speech. It was noticeable that several individuals of this tribe suffered from palatal abnormalities, and the above-mentioned modifications may be due to this factor, the manner of speech of the abnormal individuals having become the norm for others of the group.

In the following vocabulary there are approximately 2,000 native equivalents for some 570 English words. The Mutumui and Walmbaria words were written down by direct translation into English with an interpreter. The great majority of the others were obtained as direct equivalents of these words without the use of English.

Our notebooks suggest that the details given for points of the compass may be confused.

Most of the English words used in compiling the original lists were selected from Roth's vocabulary of the Kokoyimidir, in order that they might facilitate the future comparative study of the northern languages.

The Flinders Island natives have a collective word, *ngakulkin*, for many animal foods. Such terms are rare in some southern languages. In this term they embrace land mammals, the whale, lizards, fish, snails, shell-fish, and green tree ants.

The importance to the coastal and island natives of the shallow-water fishes as a perennial food supply, such as can be speared by walking in the surf at low water, is shown by the extensive series of names for species of stingrays, sharks, and other shore fish detailed in the vocabulary. In addition to those listed, many other species which we were not able to recognize were made known to us by name.

A few recently introduced words are recorded in their places in the vocabularies.

The origins of the native terms for some foreign articles, e.g., "bottle", "gun", etc., have not been recognized. In the Gulf of Carpentaria many of them are of Malay origin. One word, 'kalako', for pubic tassel, is obviously English (calico). The influence of visiting pearlers may be reflected in the general Mutumui word for bird, 'tori-tori', which is a duplication of the Japanese word 'tori'. A similar origin may be postulated for the term 'kani' for trade tobacco, which compares well with the Japanese word 'kane', meaning "money".

The accompanying vocabularies are placed in four columns; in each case there are dialectic variations, which are shown in brackets. The few words by Curr, on the authority of Hodgkinson ([27]), from Princess Charlotte Bay are the only ones recorded from the district. They have been placed in the English column for comparison and reference. They appear to agree best with those recorded in our vocabulary for the Barunguan tribe.

([27]) Hodgkinson, in Curr, Australian Race, ii, 1886, p. 389-391.

English.	Mutumui Tribe. The language called Eibole (Ebole, Eipolin), together with the Ongwara (Baulam) dialect (in brackets).	Walmbaria Tribe. (Retjringa, Mba, Wonkayi). The language called Yalgawarra, together with the Tartali dialect (in brackets).	Kokolamalama Tribe. (Wanbara, Bakabanambia). The language, together with the Yetteneru dialect (in brackets).	Barunguan Tribe. (Ba, Baka, Banjingam). The language, together with the Ompeila dialect (in brackets).
above, high up	——	alpu	——	——
across, over	atendowalo	——	——	——
adder, death- (*Acanthophis antarcticus*)	walan'gar	——	kabaro	(iyaramu)
alive	ngamboara	——	o'obar	——
animal	'yorlpan	——	——	——
animal food; general term	——	ngakulkin	——	minya
ankle	'armun	edaimbal	(malukul)	——
ant	——	wundu	——	——
ant, green tree (*Oecophylla smaragdina*)	wundu	walela	yu'war (ou'ar)	woruko (onta)
ant, green tree, female of	aral	aral	——	——
ant, green tree, nest of	inta	inta	——	——
arm	ungun (omborir)	mangal (artta)	tambal, ardun	ponta
armlet	opuel	——	——	kanka
armpit	awul'war	upapul (walwa)	——	watta (watta)
ashes	'workan	teide	(thejer)	poruka
backbone	omwol	aruga (lbo, lbon'gar)	——	——
back of neck	tunku	wurungu (relkama)	orupun (ol'warmar)	——
bad; wicked person	wara	waraki, warawi	nejir	——
bag, dilly-	——	okotomo, okutomo	armar	——
bag, string dilly-	(onyin) (worunga)	okutomo	tapul	owuntji
baler-shell (*Melo diadema*)	wongoral (waal)	adaala, adola	wanam (awanam)	deilamba, tilumba (mimpa)
bamboo (for spears and pipes)	——	antamu	——	tatau
bandicoot (*Isoodon macrura*)	——	——	rutun	(kolpa)
barramundi (*Scleropages leichardti*)	imuar	——	erboar	attinyu (attinyu)
bark, of tree	alarumbuar	waltja	——	——
basket (folded palm leaf)	——	waltji	arija (oppa)	olku
basket (twined grass)	atea (alti)	waltji	tjan	——
beach	——	iwala	——	——
beard (watta *fide* Curr)	ngandeal (ngandeal)	alpal (talalpar)	——	——
beckon, to	aruwala	ongaye	delwai	——
bee, native (*Trigona*)	wamar	ngamo	mayapor	kawa (wiriki)
bee, honey of native	olkal	ngamo	wonum	mayupu (mayupu)
bee, wax of native	wamar (wamaruka)	tabayi, tori	loppa	wirki
beetles (*Cetonid, Longicorn*, etc.)	——	tupiala	——	——
behind	yawal	——	——	——
belly	ambul	wawu (ambul)	arka'bar (agapar)	poya, tulyi (poya)
bird	tori tori	——	——	tarra
bitter, salty	——	uguyulpu, uluwara	tean	——
black	——	wolpai	——	tonga-tonga
blackfellow	amma (ama)	abba (arwun)	(apma)	pamma
blood (of man, animal or fish)	——	mendayi	——	kammo
blow, to	tambila (wundyuru)	——	——	liril
blowfly	——	——	'ar mul	——
blunt	——	warawi	koin pampan	——
boat (foreign)	——	——	——	kawuta
boat, foreign two-masted	——	——	——	yuro-paham
bone	womol	——	(ethal)	——

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
boomerang (winche *fide* Curr)	——	——	tarumbu	——
bottle (flotsam)	kapimo	——	——	——
boy	ainjir	walngo	——	mokkan
boy, small	——	waruka	yalyanmai	tjoitjo
break	olngata	eital, ikarla	dopal	——
breast (chacha *fide* Curr) ..	oyuempar	oyonga (ayum)	yum	tjotjo, nyuwanyu
breast, nipple	oyua	worumba (lir)	(oyang)	tjotjo
breath	ompoimo	wawu (mbom)	(ngaalal)	——
broken	——	eital	——	——
brother, etc.	——	arugai	——	——
bucket, or drinking vessel ..	——	——	bolpam	——
build, (a hut) to	——	aralmininbala	ngalutagan	——
bury	——	wabayala	phur wongal	——
bustard, Australian (*Eupodotis australis*)	yembar	——	'ar whar	natja (mantapa)
butterfly	——	motjala	——	——
buttock	——	moyu	——	kalla (kalla)
calf	talmbayopal	yulpan	——	——
call, to	urpili (owure)	bamanjal	phukaneim	——
camp (wippe *fide* Curr) ..	awur	ambawanga	arir	——
candlenut (flotsam from elsewhere)	wondundu (wondundu)	tortorwul	——	——
canoe, outrigger dugout (tandi *fide* Curr)	alemia, agale (alemia)	akaala	tuppal	tanju
canoe, outrigger, booms of ..	takkal	aipar	——	——
canoe, outrigger of ..	apa	appa	——	——
canoe, paddle of	werapa	wiriapu	——	——
canoe, prow of	torinji	alpayi	——	——
canoe, stern of	tongal	turiene	——	——
cassowary (*Casuarius casuarius*)	——	topanpo	dopanpo	katjabanko, lampi (nampi)
cat, native (*Dasyurus hallucatus*)	tekul	wanindil	——	(ampoyu)
channel-bill (*Scythrops novaehollandiae*)	warkeal (woke)	——	——	——
cheek	murukul	murkul (retalnga)	(olowen)	waango
chest	wakka (yawul)	werta (naratu)	'dor ham	owan, pina (owan)
child	eitja (eitja)	tjitjanga	yalnandawa	kahi, wopoyi
child, newly born ..	——	warpar	——	——
chin	ngandear	takkal dul (taradu)	'arbuar (wap'par)	kattu, ngeke (ngeke)
chiton	wallu	——	——	——
cicatrix (on chest and shoulders)	——	ambu	boar	——
clean nose by blowing, to ..	——	——	ofothir	——
clear sky	eiti	——	——	——
climb (trees), to	——	matealla	dhor-thratal	——
cloud	——	tabwara	——	tatala
cockatoo, black (*Calyptorhynchus banksi*)	——	——	tenyango	(keila)
cockatoo, white (*Kakatoe galerita*) (wattalda *fide* Curr)	arumbual	——	——	(paipa)
cockle	——	matayi	——	——
coconut (flotsam)	wowunba	alulu	reikuru	——
cold (pitja, in Karnyu language)	——	manjar	tjial	——
come, to	arwandula	——	——	——

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
come (imperative)	arwala (arwala)	ongaye, ippara	delwai	——
come (to many)	——	——	batjwandema	——
complain, to	——	——	pipiyi	——
cook, to	——	——	mulin	——
corpse	——	tuyu	a'tur	——
cough, to	——	——	thrimin	——
crab	nokotakka	apoyi	arfiar (ebewu)	i'moyu
crab, hermit	——	taramba	——	——
crab, mangrove (*Thalamita*)	waandun	apoyi indulka	——	——
crab, running (*Ocypode*)	waandun	anjai	——	——
crab (*Scylla*)	ikenji	apoyi	——	——
crab (*Xanthias*)	——	ambierta	——	——
crab (*Uca*)	wore	apoyi	——	——
crayfish or rock lobster (*Panulirus ornatus*)	ekenji	mokowala	koparing (otjorowonwon)	paku
creek, or river	——	aya	——	manka
crocodile (*Crocodilus porosus*)	anear	——	ndar	ngapu (ngapu)
crocodile, nest of	enta	——	——	——
crocodile, young	oguan	——	——	——
crooked	——	wurungur	angeal-angeal	——
crow (*Corvus cecilae*) (telpee *fide* Curr)	arkingea	wata	wawabalo	(taeta)
cry, to	yelpal	ogo	ijun	——
cut, to	oltomola	undala	polpol	——
daytime	ankoan	wondeiwa	(e'bar war)	bungako (tawaya)
daughter (male speaking)	——	alkur	——	——
daughter (female speaking)	——	arwui	——	——
deep down	——	wakku	——	——
die, to	undiyi	tuyu	baturhama	——
dig, to	akala	wabaye	retal	——
dish (bark trough)	——	waltji	arija (oppa)	olku
dish (*Melo* shell)	——	adola	——	tilumba (wanam)
dive, to	oruma	watarumbaala	arumianga	——
dog, native camp- (*guarga fide* Curr)	otea	——	towarpanam	koaga, okokoyi
dog, wild (*Canis familiaris dingo*)	tomboya	——	towar	arkamu
dream, to	etear	ikara	——	——
drink, to	yatiar, yetangur	adultjala	thredala	——
drinking vessel	——	——	bolpam	——
dry	——	mandi	thdero	——
duck	otunga	——	lilu, nirubu	——
duck, white-headed Shelduck (*Tadorna radjah*)	——	——	korli	——
duck, black (*Anas superciliosa*)	alpangar	——	——	tampi (tampi)
duck, plumed whistling (*Dendrocygna eytoni*)	——	——	tjibiyu	——
dugong (*Halicore dugong*)	wiyara	montawara	alputa	waitai (wataa)
eagle (*Uroaetus audax*)	tepul	——	——	——
ear (yimpa *fide* Curr)	oyen, oyel	otella (rukutu)	lambawari (itna)	yempa (yampa)
ear, pierced	——	walin	——	——
east (or south-east)	akkane	akaimo	——	——
eat, to	yatala	atala	mollir	——

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
eel	undal, yawulam (angkala)	——	——	kuttong-tjoir
egg (emil *fide* Curr)	anir	arai	adian	wimpa
elbow	——	tungu (deyambar)	——	kankol, kangula
emu (*Dromaius novae-hollandiae*) (boongil *fide* Curr)	yerkunguru (orukunguru)	——	thrimuyui	(nampi)
evening	——	——	woram	——
excrement	——	oda	——	——
eye (toontree *fide* Curr)	elanutu, elarunutu (ungulutu)	wonba (alir)	buddan (eratjar)	tontoyu (tuntui)
eye, to open	elatowangapola	eradalpo	——	——
eye, to shut	ngarlmul	ngandu	——	——
eyebrow	gugutjil	wonbaida (redier)	(erotana)	milmoya, yanko (yanko)
eyelash	larumingu	wonbatakku (lirawu)	——	watje
fall down, to	oli	monjela	——	——
fan, to	——	wayalgala	nyirwhiril	——
far away	wotte	onkara	——	——
fat, or grease	——	apayala	thruma	——
fat, solid	ngonta	ngonda	(oatjar)	——
father	——	wiakai	(yiai)	——
father, adopted	——	kagai	(yeter)	——
father's brother	——	kagai, oayi	(oayi)	——
father's father	——	purugai	——	——
father's mother	——	tabigai	——	——
father's sister	——	pakai	——	——
fibre, red wattle-bark	——	tambiara	——	——
fibre, palm (*Livistona*)	——	ngaral	——	——
fig tree, native (*Ficus*)	otei, ngon'tar	yikuwaruka	——	——
finger	——	windi	eitjelwuni	maa
finger, little	——	windi (andindi)	——	kaikera
finish	——	wiangai	rembarin	——
fire (yuma, *fide* Curr, yuma, Karnyu Tribe)	yiku (yeku)	ngawu	thran, kran (atha)	okr, uange, tumma
fire-light (melal, Karnyu Tr.)	yiku awala	ngawu (uwala)	thranuwha, aruman	——
firesticks, base (A), twirler (B)	——	oradala (A), toroko (B)	(yuwai, ewan)	tomongi; wudni (A), tadni (B)
firewood	——	ngawu	——	——
fish (yunpoo *fide* Curr; yalu, Karnyu Tribe)	ngarta, oinba	eidi	awar	minya, bangana (pongan)
fish, mud- (*Euchoristopus kalolo*)	——	murayi	——	——
fish, rock cod	wepal	weipal	——	tatila
fish, stone (*Synanceja*)	tunul	mutyunmal	ardun	toitu, piita (piita)
fish, trumpeter (*Pelates*)	——	tandeina	——	——
fish, dorsal spines of	——	alnji	——	——
fishhook, pearl-shell	wanda	abi, wanda	——	——
fishing net, oval frame	makar	woriri	(areidu)	——
fishing net, big meshed oval	wonga	——	——	——
fish, scales of	——	wotol	——	——
fish, tail of	——	oboi	——	——
fish, diamond ray (*Manta*)	——	talal	——	yua, tjulko, wonka
fish, stingray	motumarayi	ngora	——	luntitha, baalki (baalki)
fish, stingray (another species)	tomimur	tumbeimer	thoarwiri	paukura

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
fish, stingray (*Dasyatis kuhlii*)	yerendi	mali	koman	alkuna
fish, stingray, caudal spine of.	——	tati	——	——
five (also many)	untua	waruka	piaro	yali, konto
flat	——	talpal	almbar	——
fly (*Musca*)	ngawunda (orolwol)	wataala, adamo (roltji)	tjam, ka'lar mal	wullu (pulpul)
food	ayi	ngakulkin (animal food only)	ruwurin	——
foot (takko *fide* Curr) ..	oundul, wundur	yeda (opeara)	ranganu (malakappar)	tao
forearm	——	mangal	——	mitja
forehead	tetal	(albir)	umbiar (oboal)	owo, yantila (oo)
four	imbimbual	imbara	awar	atu, manko
fresh	——	yubuyapal	thramin	——
frigate bird (*Fregata* sp.) ..	——	oroti	—— —	——
frog (*Hyla caerulea*) ..	talmal (alman)	tarai	——	palwu (palwu)
ghost	——	ngoroyi	——	——
girl	ngombor, onbur	waruka	yelala	tjotjolka, wannemokkan
give me	——	waretei	——	——
goana (*Varanus gouldi*) ..	takai (ererwin)	——	aobar (erarwar)	yeta (yeta)
go away, to	atendula	wakaiyu, wokaye	nalta	——
go away, (a great distance) to	——	oteanga	arupuila	——
go away, (a short distance) to	wereangalawala	weeri	leiwa	——
go away, (for good) to ..	attenu	——	——	——
go away, you (imperative) ..	attea	——	——	——
good	——	menni	khayi	——
grandmother (indefinite) ..	——	——	(epmei)	——
grasshopper	wulnbul	yilnjerta, woppan	——	——
green	——	'wuluyur	——	——
ground, earth, country ..	——	——	——	ngaruko (ngaruko)
grow, to	——	tadealbu	arumai	——
gullet	——	yertal	——	——
gum (mouth tissue) ..	anbuar	yulpal (relnbapoan)	——	yalnmai, matalla
gum, black (for spears) ..	(otare)	——	'par	——
gum, bloodwood	otara (otare)	otara	putyol	——
gum, mass on stick, for trade	——	——	ru'war	——
gun	olanga	——	——	paruta
hair (mea *fide* Curr) ..	yawul	wokka (towar)	tjin (warepal)	yangana (yangan)
hair, pubic (both sexes) ..	karuwakka	wakka tjitjal, enkelwakka	(nerepelu)	——
hair, under arm	——	wakka (atuwar')	——	warta
half-caste	——	——	——	bulmenjima
hand (boolam *fide* Curr) ..	marra	mangal (kumanar)	etjildoa (alam)	maa, yopoko
head (mea *fide* Curr) ..	ekaruwakal, melkar	taggu (kolari)	arpuan (awar)	paanna (paan)
heart	——	wukella (rarungo)	——	——
heavy	——	ongul	ngenhukwan	——
heel	——	——	——	mota
here	wiere	akko	——	tingkingi
here, very close to ..	werekungundu	wiyeri	——	——
heron, reef (*Demiegretta sacra*)	alkun (okanambai)	——	kowam	(moaki?)
hip	moyu	wilu	——	pilu
hit, to	ambala	alkala	nyil	——
hold, to	——	atteala	——	——
hole	ongoar	——	——	——
hot (wulu, Karnyu Tribe) ..	——	abitjal	loloyi	——

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
hunt, collect, gather, to ..	——	——	monularaba, nyanara-bal	——
husband	——	adogai	(oragai)	——
husband's brother ..	——	atji	——	——
husband's sister	——	adogai	atjra	——
hut	inta	arrar	——	——
hut, framework of ..	yiku	iiku	——	——
hut, bark covering of ..	——	waltja	——	——
in front	owalmun	——	——	——
inside	alpia	waleana	——	——
intoxicating spirits (introduced)	——	aduwulu	aungathalla	——
jabiru (*Xenorhynchus asiaticus*)	muntuwur	——	trur	kutji-nitji (katjinatji)
jelly fish	——	olel	——	——
jequirity seeds (*Abrus precatorius*)	——	yenbun	——	——
jump over, cross	——	abowarala	——	——
kangaroo (*Macropus giganteus*) (yearpee *fide* Curr)	tawu	owaimini	kouwan	beon, peiwu (peiwu)
kangaroo, big red (*Macropus robustus* var.)	——	rokalu	rokalum	——
kangaroo, tall black, literally "tall"	tokanba	tokanbar	khar-mai reiangomar-ala	——
kangaroo, tree (*Dendrolagus*)	wongu	ingowata	——	——
kaolin, white	mangar	teindi	arngar	polpo (morupo)
kick, to	undundarila (tapila)	arala	——	——
knee	oppar	tungu (ng as in "sing")	yanar-pan	pung-gu, ponko
knee, hollow at back of ..	——	wakku	——	——
knife, shell-	——	atwonji	——	——
knife, stone-	atjingi (werrer)	——	——	——
language, name of ..	eibole, eipelin	yalgawara	——	——
large	——	waruka	——	——
large numbers	mimbual	——	——	——
laugh, to	ultulwi (utul)	oppi	liil	——
lead, to	——	wagaala	——	——
leave	——	——	——	waneini
leg	talmba	talumba	——	nganta
level, flat	——	talpal	almbar	——
lick, to	oltala	wataka	tarukudaala	——
lie down, to	andayi	wandayi	noal	onatali, wunambu
lift, to	——	wiambala	manil	——
light (weight)	——	tangul	kolkol	——
lightning	——	tata	——	taiweina
lip	kalmbuar	ngolngapepil (karawui)	whunaka (watanar)	kaama (kamman)
liver	teppa	warra (adir)	(anna)	——
lizard	ondandal	wonjir	kuripeinu (agu)	——
lizard (*Lygosoma*) ..	wopai	——	(a'gar)	ankai (ankai)

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
lizard, frilled (*Chlamydosaurus*)	milkarian, karuyen		kuthul (otnaruga)	awa (tawa)
lobster, spiny rock (*Panulirus ornatus*)	ekenji		(otjorowonwon)	
long		to-otal	dia'barwal	
lose, to		waranban	ngur-ngan	
make, to		menenbala		
mallet, woman's ironwood- ..		otun	mulum (angkurtin)	
man, adult	yangar	beangai		
man, big		bawaruka	khar-mai	
man, dead (corpse) ..		tuyu	a'tur	
man, dying		to-olpin		
man, married	eiryalə (eiryale)		bambuyi	
man, old	wulpu (wulpu)	olpo	arburi	jilbo
man, single			fuhuri	
man, track of (takko *fide* Curr)	wundul	(amba)		
man, young	ainjin (ainjin)		whitjinu	wuntja wantja (wonga wonga)
mangrove	artan		thuri	
mangrove (edible species) ..	wambur	wambur	mohayitha (th as in "the")	munerum
mantis (*Rhodomantis* sp.) ..		workeala		
many	waruka		wharmai	konto, yali
march fly (*Tabanus*) ..	enti	wendi	rein, eriet	
message stick	eiku	maka		maka
midday		tela'rai pan	wunarea	punga kayarri
milk	oyuwa			toutu
moon (arpe *fide* Curr) ..	wondal (wontal)	tajiwuja	kokal (ebar war)	piiti, tauyaha?
morning			tjatja	
mosquito (bulbul *fide* Curr) .	wongwal	obo	ngul	wungu (ponyi)
moth		mutjala		
mother		maai	(amayi)	
mother's mother		tatjikai		
mother's sister (elder and younger)		kagai		
mountain	wondal	wondal	armian	yoiko (yoiko)
mouse, native		ankamo		watti (otti)
moustache	walar	wakka (talalpar)	(wapar)	pujuna, yangan (yangan)
mouth (kama *fide* Curr) ..	'arkar	watata (karakutu)	kalumbuar, banambda	kama
mud		alpur		wonka (wanka)
mullet			akthrur	
nail (claw)	marolki	windi	(maluethal)	
native companion (*Grus rubicundus*) (bundeela *fide* Curr)	orupal	ungawu (ungawu)	kurkur	dolga (pondeila)
neck	mannu	'targir	nabithal (anathal)	manua (mannu)
necklace, grass bugle ..	atea	merko		patja
necklace, pearl shell ..	anir			patja
necklet, pearl shell ..	omareru (omareru)			
nice (good looking) ..		ngorupal	mboyayi	
night	annenbai	ngotowo	beimi (woppengeme)	patpi
no	mariyan (arukan)	wiyangai		

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
north (or north-east)	pngwara	ongare	— —	——
nose (muntyin *fide* Curr)	oyenba	ngolma (weku)	wurman (ngarata)	niyi (niyi)
nose, pierced	——	——	upul	——
nose, ornamental pin for	oyunba	——	duun (mareti)	——
nostril	onguar	onmawalin (alkutu)	——	——
old	——	warawi	ngir	——
one	uponu (uponu)	wodumo	hana'whar	tunungo, nilama
opossum, ringtail	tangoro (worungal)	——	kutal	——
opossum (*Trichosurus*) (koolan *fide* Curr)	oyenbi, oyanumbir	alpi, olnbi	lowan	umpoyu, kolana (kolana)
order, or command, to	——	olle	——	——
outside	ngande	walpuara	——	——
over	atendowalo	——	——	——
oyster, mangrove	wamman	makul	mawur (itjrin)	umute, kamaka (makoyi)
oyster, rock	——	makul	——	——
pad (native track or road)	——	(ngaralkoa)	— —	——
paddle	——	reiwu	reiwu	——
paddle, to	——	warukeala	——	——
palm tree (*Livistona*)	antir	andi	potjyol	——
palm tree, wood of	——	tokoyi	——	——
palm vine ("lawyer")	tambal	——	——	— —
pandanus, "screw-palm"	wial (when low and scrubby), opuel (when mature tree)	wiangar	pandua	——
pandanus, fruit of	——	——	poljor	— —
pandanus, nut meat of fruit of	——	——	sthamtan	——
pearl shell	waruwa	weiapa	——	walanga
pelican (*Pelecanus conspicillatus*)	alpongoro	—	whombirinu	matuya (matuya)
penis	——	wonda	whumbia	wanga, wonga
phosphorescence (in the sea)	——	irimar	——	——
pigeon, white	worukoi, wurukui	——	rukai (otjthran)	pultu, owaran
plain (level country)	——	——	——	palki? (mangili)
pointed, sharp	——	yelpai	balbada	——
porcupine, native (*Echidna*)	moitoni (arayil)	argingili	——	kanuma (kauma)
porpoise (*Delphinus*)	——	elpal	antjada	witju
prawn, snapping (*Crangon*)	——	agualda	——	——
prickly	——	atjal atjal	——	——
pubic hair (both sexes)	karuwakka, enkelwakka	wakka tjitjal	(nerepelu)	——
pubic tassel (calico)	kalako	——	——	arama
pull (up), to	——	angeala	——	——
pull (along), to	——	wagaala	——	——
push, to	yetengar	yagala	meangal	—
put down, to	——	ambala	——	——
quail (*Turnix* sp.)	tapar	——	——	——
quick	——	apin, embal	——	——
rain	——	adi, adi'waruka	arngan	yangkui, iimpi
rainbow	watin	morda	——	——
raincloud, black	ngoungun	——	——	——
red	——	adda	——	——
red ochre	orungur (otjir)	orungul	towarin	koppa (po-ota)

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
reef, coral	——	moruku	——	kulla, tjayuka
refuse, to	——	weyankai	'ngartjin	——
rib	warun'gear	wangeana	(a'tjar)	waamo
rice, wild (*Oryza satira*)	——	——	'ar mama	——
river	——	aya	loaka	kopoka, manka (attapa)
rockshelter (wet season camp)	——	edidana	——	——
rope	andear	——	——	——
rough	——	atjal	dadarumo	——
run	——	——	piarkaril	——
run away with, to	——	aboarala	karilao	——
sand, sandy country	toweir (awur)	eiwala	nar	malkana (mankan)
sandfly	indi	odugo	tortor	ko-ontu (ko-ontu)
scratch, to	yenba	yarupaala	ariamu	——
scrub fowl (*Megapodius reinwardt*)	toka	——	——	tuutu, (wonta)
scrub turkey (*Alectura lathami*)	toka	——	——	tuutu, nii-tja
sea	talun	wulu	'thredtan	olanda (olanda)
seagull (*Larus novae-hollandiae*)	——	arwora	——	——
sea louse (*Excirolana orientalis*)	——	meljeri	——	——
seawater	talun	ogu	(kudom)	koitu
shadow	'ngorwan	walle	——	weipa
shake, to	——	oyungala	dojindangal	——
shallow	——	warpal	reharuka	——
shark (general)	ngammu	wutayi	——	mawara (mawara)
sharp	——	yelpai	balbada	——
shell, baler (*Melo diadema*)	wongaral (waal)	adola, adaala	wanam (awanam)	tilumba (mimpa)
shell, cockle	——	matayi	——	——
shell, cockle (*Arca trapezia*)	——	otoltol	——	——
shell, giant clam (*Tridacna gigas*)	——	yiramal	('ede)	——
shell, pearl (*Meleagrina margaretifera*)	waruwa	weiapa	——	walanga
shell, pearly nautilus (*Nautilus pompilius*)	(ani)	tombolmo	——	——
shell, periwinkle (*Natica* sp.)	wongarwul, wongar-'wer	yapal	——	——
shell, snail, edible (*Thersites bipartita*)	tale (undir)	wataka	——	——
shell, trochus (*Trochus niloticus*)	apinga	opinga	——	kannin
shield, *also* wood (cheege *fide* Curr)	yiku	——	——	——
shin	wundul	ngulmani	arpuman	tao, tale, tali
short	——	noambar	boyungan	——
shoulder	tampal	worupa (arenga)	——	panta, temman (temman)
shrimp (generic)	wakal	mokowala	——	——
sick	——	warawi	mangear	——
sister	——	pakai	——	——
sister's daughter (male speaking)	——	arwui	——	——
sister's son (male speaking)	——	ambui	——	——
sit down, to	ongata	inala	relnyal	——

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
skin	——	takkur	——	kolkol
skull	wommol	takku (akku)	(ethal)	nganta
sky	——	'ngartjin	——	——
sleep, to	andayi	wandayi	thainol, sainol	wunambu, onatali
slow	——	mangayi	——	——
small, also thin, etc.	——	tjitjanga, wirungal	——	——
smear, or grease, to	——	mola	——	——
smoke (tumpa *fide* Curr)	wummun (worpar)	wopal	arún'gil (ongolar)	ngokka
smooth	——	ngorupal	——	——
snake (yeerum *fide* Curr)	arukui, alkui	——	'mar	(po-a)
snake, carpet (*Python*)	——	——	menakayi, atiwiti (toruga)	(kappal)
snake, gigantic poisonous (*Oxyuranus scutellatus*)	——	——	mumbarudi	taipan
snake, poisonous (not determined)	——	——	fori	——
snake, sea- (*Hydrus*)	eitjana	tarupayi	——	powa, kangita (powa)
sole of foot	——	takkur	——	——
son (male speaking)	——	apo	——	——
son, female speaking)	——	ambui	——	——
sore	murur	——	(ogoar)	——
south (or south-west)	ippene	eppare	——	——
speak	——	erukaala	——	——
spear (kulka *fide* Curr)	alka, awita	alka	'la	kalka, kaka
speargum (bloodwood)	otara (otare)	otara	——	——
spear-smoother (hardwood)	(oruwur)	obamangal	(ruwal)	——
spider	——	marara	——	——
spittle	——	ngundu	——	katti
stand up, to	torukul	——	ngorhal	——
star (tumpe *fide* Curr)	amarkangan, amar'kan (mera)	amarakanga	thridinam (erepe)	tunpi, tumbi
starfish	——	yeralji, warar	——	——
stay away one night, to	oruburuponu apil	——	——	——
stay away two nights, to	orupoteala apil	——	——	——
stay away three nights, to	orupulundu	——	——	——
stay away altogether, to	attenu	——	——	——
steal, to	arpila	tokanban	oraltangal	——
stick-insect (*Phasmidae*)	——	ngarai	——	——
stomach (toolka *fide* Curr)	ambul	——	——	——
stone (koola *fide* Curr)	olpai (tanil)	——	bulinam	natja-mo (natja-mo)
stone, large	——	amarkanga	——	kol-a (kol-a)
stop, to	——	inala	——	——
straight	——	ngoru'par	'ar pungar	——
string, two stranded native-	andeir	totuanga	ngiar (oamman)	——
strong	——	waippal	——	——
sugar, or sweet substances	awur	——	——	otjua
sun (wootcha *fide* Curr)	wokear, wokkar	woga (tela)	'nar (eira)	punga, kampella
sunrise	——	wogaruluge	(eirathalnema)	pungawawayi
sunset	——	wogarumbale	(eirongoiyan)	pungataaka
swallow, to	yewarta	ngorparu, yagaala	phongalao	——
sweet	——	yoppa	adunadam	——
swim	——	wondala	——	——
tea (the trade article)	yekel	——	——	alir
tears (weeping)	e'larworumor	mola	——	——
termite	——	ngakul	——	——
termite mound	——	otum	——	——

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
testicle	——	odul	adoal	wokana, wakkal
there	otte angandu	akkaiya	——	——
thigh (puhn *fide* Curr)	marantal, uman	aruga	arar	nganta, kantana
three	ountua (ountua)	erungo	barubuiban	untu, kukuti
throat	manu	o-oko (nutalnga)	——	wika (manno)
throw, (spear, etc.) to	——	adeala	——	——
throw away, to	——	adeala	——	——
throw down, to	——	ambaradeala	larumarinyal	——
throwing stick, slender type (bootcha *fide* Curr)	——	akeruman	enam, einam	——
throwing stick, flat type	——	akeruman	fhungalai	——
thumb	——	windi	——	maapapa, maapa
thunder	——	——	——	malundiji
tie up, to	——	mondala	——	——
tired, to become	——	alge yertjin	real'turia	——
ti-tree (*Melaleuca*)	——	oatul	——	——
tobacco (trade article)	——	matja, warai	arngan	keini, kani
toe	——	windi	ranuwuni	——
toe, little	——	windi (deambui)	——	tjotjo
toe, under the	——	olor	——	——
tomahawk (wakko *fide* Curr)	tappir	mitan	dundenu	aimala (aimala)
tomahawk, stone head of	——	idital	——	——
tongue (darbi *fide* Curr)	athawatha, wathatha	wolkel (alala)	tainambda	taapi
tooth (kummun *fide* Curr)	'ngarwar, arwen	wanda (relnba)	erierman (wagun)	kumuna, kamman
tooth, knocking out of	——	gulwanda	——	——
tooth, falling out of	——	monyin	——	——
tortoise, freshwater	tokol (aruyel)	——	——	——
track (or footprints) (takko *fide* Curr)	wundul	amba	——	——
trade parcel (more recently money)	——	——	——	yanpangi
turn, (the head) to	——	weagala	——	——
turtle	yetal	——	woar	——
turtle, green (*Chelonia mydas*)	——	——	——	tokla (tukul)
turtle, leathery (*Dermochelys coriacea*)	ngapoyi	ngapoyi	——	eira
turtle, loggerhead (*Caretta caretta*)	arayil (okolopo)	aratal	oratal	wapuna, luppu (luppu)
turtle, shell or hawksbill (*Eretmochelys imbricata*)	noreimba (yalnga)	takayi	teangai	karkara (karkara)
turtle, egg of	anir	——	——	——
turtle, flippers of	torumbal	——	——	——
turtle, nest of	talu	——	——	——
turtle, shell of	omual	——	——	koinungaya
turtle, snout of	okol	——	——	——
two	oteara (oteara)	uteara	sho'war	pahamo, kouti
umbilical cord	——	ngaka	——	kapamo (kapamo)
umbilicus	wundu, ambulwunur	wadu (ambulayur)	(ottal)	ngotjoro
untie, to	——	algaala	——	——
urine	——	ombo	——	——
vegetable food (yams, roots, flour)	ayi	——	(omman)	mayi
vomit, to	——	abba	ngowaram	——
vulva	——	en-gul	kun	pukana, pinyu

English.	Mutumui Tribe. (in brackets, Ongwara)	Walmbaria Tribe. (in brackets, Tartali)	Kokolamalama Tribe. (in brackets, Yetteneru)	Barunguan Tribe. (in brackets, Ompeila)
walk, to	wundul (atunu)	okayi	——	——
wallaby, agile (*Macropus agilis*)	oruyu	tukun	——	——
wallaby (*Onychogale unguifera*)	tokanbar	alpaala	arbimburwir	——
wallaby, rock (*Petrogale cf. assimilis*)	olpara	tawu	kunyur	tu-u
wash, to	——	apaala	indawaranga	——
wasp	(wuru)	worun'bar	——	——
water, fresh (pii, Karnyu Tribe)	uwere, temuna, oware (atiar)	adi	thrida (erete)	opala, ipi (pii)
waterlily (*Nymphaea* spp.)	aruru (otama)	ngundii	——	——
wattle-bark fibre	——	tambiara	——	——
wattle tree (*Acacia* sp.)	——	marpi	——	——
wax	wamar (wamaruka)	tabayi, tori	loppa	wirki
weak	——	toalpin	ngunkilkir	——
west (or north-west)	awanam	owale	——	——
wet	——	manji	thdedu	——
whale	yalumburunda	arkeita	kortawari	mattu
what is it?	ngailo?	ngane?	anilai?	——
where is it?	——	anda?	——	——
wherein	——	andalo	——	——
white	——	waindil	——	——
white man (parra *fide* Curr)	nembara (temmara)	rabayi (muru)	ngar	para
wife	——	awuna	——	——
wife's father	——	abibi	——	——
wife's mother	——	maiani	——	——
wife's sister	——	arua	——	——
wind	——	waya	po-om	wunda, wunta
wind, north-east	——	wayaongare	——	——
wind, south-east trade	——	wayakamin	——	——
wing	ombomo	——	——	——
woman	aningir, alingir	ngambul (tamba)	dappa, dabahayii	antayu
woman, single	——	wurupali	ararar	antea, wopoikanyu
woman, old	——	anjul	——	wentja-wentja, winga-winga
woman, young	——	wurupali	yalyumalbin	wopoikanyu
wood (yoompa *fide* Curr)	yiku	——	duun	yoko
wurley or hut	enta (enta)	——	——	——
yam (*Dioscorea sativa*)	ambayil (tapal)	walkar	warkayi (e'bar)	——
yam, some other	——	——	arunguia	——
yamstick, women's	——	——	rebur	——
yellow	——	'warpar	——	——
yellow ochre	wilpiar	wo'lir	——	——
yes	anna (anna)	alukuruki	——	——
you go first!	akokoi	——	——	——

SUPPLEMENTARY NOTES.

Enquiries among the people mentioned in this paper did not bring to light any knowledge of the bow and arrow. On an earlier visit to Cape York Peninsula one of us (T.) saw children using small bows and arrows at Batavia River

on the west coast. They stood in the breaking surf and aimed small arrows at fish which were momentarily visible as the combers curled. They also shot at garfish from small outrigger canoes which they paddled about in the weedy shallows. The bow was comparable with that figured in the English edition of Ratzel ([28]) as probably from Cape York, and was made from a simple unsplit piece of mangrove wood from two to three feet in length. The arrows were from twelve to fifteen inches in length and composite, an unbarbed palm or other heavy wood point being fixed into a reed shaft.

In the Princess Charlotte Bay area boomerangs are not used. Only the Kokolamalama have a name ('tarumbu') for boomerang. It is a weapon which is known to them by repute through contact with natives to the south and south-west of the coastal area under discussion. Our enquiries lead us to believe that the boomerang is not in use anywhere on the Cape York Peninsula.

Thomson ([29]) has described fire and mourning ceremonies of the 'Ompela' and 'Yintjingga' groups of the Barunguan Tribe. Our accounts (*antea*, p. 94, etc.) may therefore be regarded as supplementary. The 'mola' strings mentioned by him are shown in our fig. 70, and are described as 'mourning strings'.

Banfield ([30]) describes a native companion dance by men from Princess Charlotte Bay; the performers painted themselves with streaks of white and "pink" clay. Wearing hair and feather decorations, they formed a circle, and, bowing to the centre, threw their hands out behind their backs and whirled about, imitating the noise of the birds. They flapped with their arms and came suddenly to a dead pause in unison. Hollow logs and boomerangs (the latter perhaps being acquired cultural objects) were employed to beat time.

The same writer also describes a dog dance in which the performers imitated the behaviour of two angry canines, progressing in spasmodic jerks and working up to a snarling, snapping climax.

([28]) Ratzel, History of Mankind, i, 1896, p. 354.

([29]) Thomson, Man, 32, 1932, No. 198.

([30]) Banfield, Confessions of a Beachcomber, 1908, p. 273.

PELECYPODA OF THE FLINDERSIAN REGION, SOUTHERN AUSTRALIA

No. 3.

By BERNARD C. COTTON, Conchologist, South Australian Museum.

Fig. 1-7.

Family VENERIDAE.

This has proved one of the most difficult families to classify. Probably the list of South Australian species should be as follows:

Dosinia crocea Deshayes (= *circinaria* Deshayes), *D. victoriae* Gatliff and Gabriel (not *D. histrio* var.), *D. sculpta* Hanley. *Sunemeroe aliciae* Adams and Angas (type from Encounter Bay). The last is very closely allied to *S. vaginalis* Menke, but apparently different. If it is the same species, *S. vaginalis* has priority by twenty years. *Gouldiopia* (1) *australis* Angas, *Circe weedingi* sp. nov. described below. *Notocallista kingi* Gray, *N. planatella* Lamarck. *Tawera* (2) *gallinula* Lamarck, *T. lagopus* Lamarck. *Chioneryx cardioides* Lamarck (= *Venus stiatissima* Sowerby). *Placamen placidum* Philippi, *P. tiara* Dillwyn. *Bassina disjecta* Perry, *B. pachyphylla* Jonas, *Gomphina undulosa* Lamarck. *Eumarcia fumigata* Sowerby. *Katelysia corrugata* Lamarck (= *scalarina* Lamarck), *K. peroni Lamarck.* [*K. corrugata* and *K. peroni* are the sand and mud cockles respectively. These two common bait cockles are extremely variable, and although one is disposed at first sight to divide them into innumerable species, after careful examination of many specimens not more than two species can be recognized. Although both may be found living together, *K. corrugata* predominates on sandy beaches and *K. peroni* on muddy beaches.] *Venerupis exotica* Lamarck, *V. mitis* Deshayes, *V. diemenensis* Quoy and Gaimard, *V. crebrelamellata* Tate, and *V. crenata* Lamarck.

The remaining three species of *Venerupis* may be allotted to two subgenera, as follows: Subgenus *Pullastra* (3) *V. galactites* Lamarck and *V. flabagella* Deshayes. Subgenus *Claudiconcha* Fischer 1887, *V. cumingi* Deshayes.

From Western Australia Verco dredged *Venerupis exotica, V. flabagella, V. galactites, V. crebrelamellata,* and *V. iridescens* at localities between Albany and Fremantle.

CIRCE WEEDINGI sp. nov.

Fig. 3 and 4.

Shell subtrigonal, rounded, truncate posteriorly, about as high as long, very depressed; cream or very light fawn coloured, usually without a vestige of radials though sometimes with one narrow, indistinct reddish-brown radial stripe; tinged with light fawn or violet within; hinge deep, middle cardinal teeth strongly developed; concentrically, irregularly, rugosely sculptured; obsoletely divaricately sculptured about the umbonal area; inner margin of shells smooth.

Holotype. Height 56 mm., length 56 mm., and breadth of joined valves

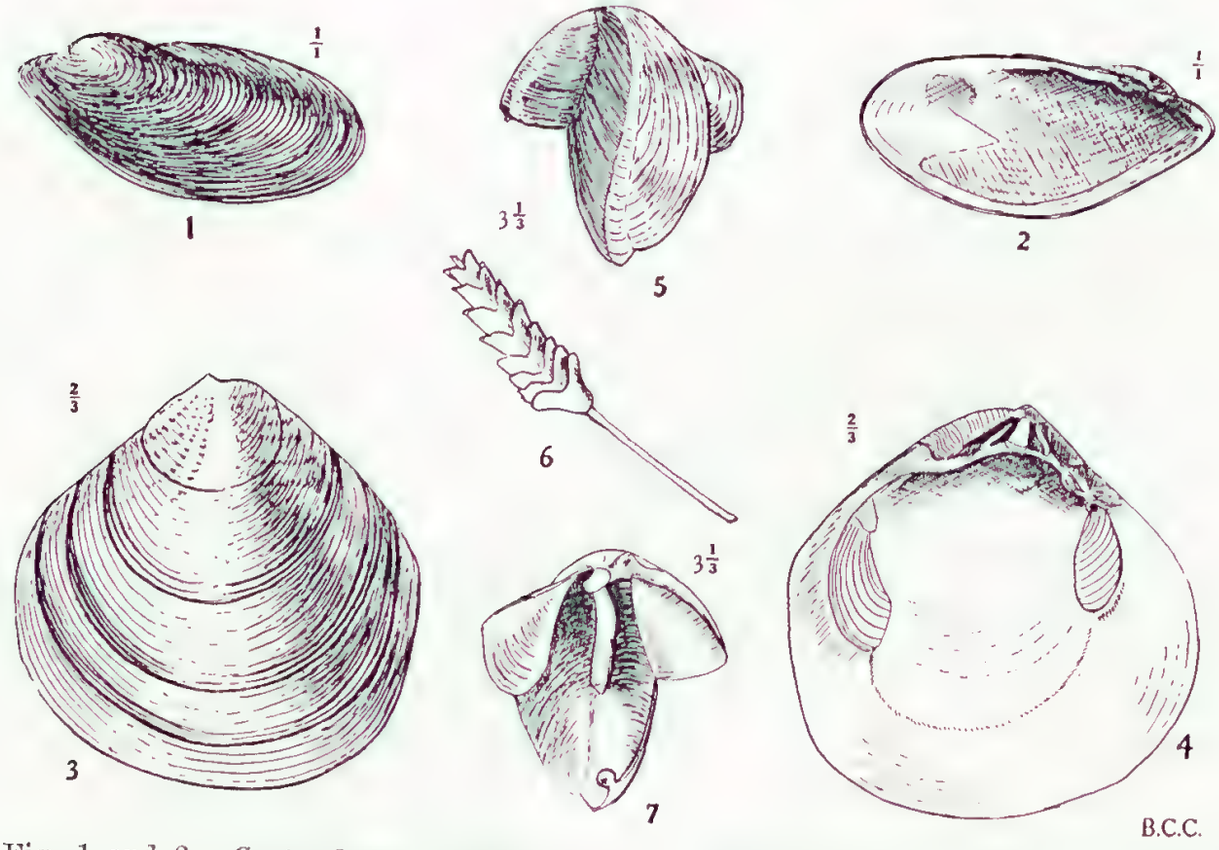

Fig. 1 and 2. *Gastrochaena frondosa* sp. nov. Fig. 3 and 4. *Circe weedingi* sp. nov. Fig. 5, 6, and 7. *Bankia gabrieli* sp. nov.

18 mm. Minlacowie, West Coast of Yorke Peninsula. In South Australian Museum (D. 10957).

Common in Spencer Gulf on the beach to 15 fath.; good beach specimens being taken at Wallaroo. It is very rare in Gulf St. Vincent on the beach, but is more commonly dredged down to 20 fath.

At Murat Bay a slightly more obese form occurs as a subfossil. Flindersian specimens are somewhat like Reeve's illustration (4), which, however, is not the shell described in the corresponding text as *C. rivularis* Manke, the red-striped smaller shell shown at fig. 3 b in the same publication.

C. weedingi is separable from other Australian species of *Circe* by its irregular concentric sculpture, lack of colouration, the weakly developed divaricate sculpture found only in the immediate vicinity of the umbo, and the comparatively greater height. The ratio of the antero-posterior diameter to the umbo-ventral is seven to six in a juvenile, and one to one in an adult.

None of the numerous described forms allied to the Peronian *C. quoyi* agrees with this Flindersian species. It is named after the Rev. J. B. Weeding, of Hallett, whose discriminate collecting of shells from the western coasts of South Australia is providing valuable data.

FAMILY PETRICOLIDAE.

In the Flindersian region there are three representatives of this family. *Naranio (Velargilla) rubiginosa* Adams and Angas occurs in both gulfs alive from 5 to 20 fath. The type from Port Jackson 4 fath. 13 mm. x 10 mm. Tasmanian specimens attain to 19 mm. x 14 mm., but in southern Australia 11 mm. x 8 mm. seems to be the maximum size. Verco dredged this alive at Albany in 20–28 fath. Specimens in this Museum from South Australia bearing the name *Choristodon divaricatus* Chemnitz are merely variants of the above. *Naranio lapicida* Chemnitz we have from Port Willunga, Port Lincoln, St. Francis Island Beach to 35 fath., also Albany, Bunbury, Yallingup, Ellensbrook, and Fremantle Beach to 35 fath. Tate compared Port Lincoln specimens with the type and pronounced them identical.

FAMILY TELLINIDAE.

The following species occur in South Australia:

Tellina albinella Lamarck, *T. aldingensis* Tate, *T. ensiformis* Sowerby. *Semelangulus subdilutus* Tate, *S. vincentianas* Tate, *S. tenuiliratus* Sowerby. *Macoma (Salmacoma)* (?) *deltoidalis* Lamarck, *M. modestina* Tate, *M. semifossilis* Sowerby. *Pseudarcopagia victoriae* Gatliff and Gabriel. The following species have been erroneously recorded from South Australia, and have never been taken there to our knowledge: *Tellina virgata, T. staurella,* and *Metis umbonella.* Between Albany and Fremantle Verco took *Tellina aldingensis, T. modestina, Semelangulus subdilutus, S. tenuiliratus, S. vincentianus, Macoma semifossilis, Pseudarcopagia victoriae,* and some four or five as yet unidentified species.

FAMILY SEMELIDAE.

South Australian species are: *Semele exigua* Adams, *S. ada* Adams, *S. monilis* Adams and Angas. The last has also been taken at Bunbury beach, Western Australia, in 15 fath.

FAMILY GARIDAE.

From South Australia we have *Gari livida* Lamarck, *G. alba* Lamarck, *G. modesta* Deshayes, *G. brazieri* Tate, *Soletellina biradiata* Wood, *S. donacioides* Reeve (= *florida* Gould preocc.). *G. livida* was taken at Albany and Rottnest down to 28 fath., and *S. brazieri* at Albany and Bunbury down to 35 fath.

FAMILY SOLENIDAE.

Solen vaginoides may be added to the Western Australian list, as it was dredged at Albany in 22 to 35 fath.

FAMILY DONACIDAE.

From South Australia we have: *Donax (Deltachion) electilis* Iredale, *Donax (Hemidonax) chapmani* Gatliff and Gabriel, *Donax (Plebidonax) deltoides* Lamarck, *Donax (Tentidonax) veriunus* Hedley (St. Francis Island, 35 fath., typical), identified by Hedley. *D. chapmani* was taken at Albany, Bunbury, and Rottnest down to 28 fath. *Donax deltoides* is plentiful from Encounter Bay southwards. It is fairly plentiful at Sellick's Beach, and is actually said to be found alive as far north as Port Noarlunga. Being a favourite bait cockle it may have established itself in these places through being transported there by fishermen. The empty shells are found wherever fishing is carried on.

FAMILY MACTRIDAE.

South Australian species are: *Mactra (Austromactra) rufescens, M. australis* Lamarck, *M. (Nannomactra) jacksonensis* Smith, *M. (Diaphoromactra) versicolor* Tate (= *corrugata* Tate), *M. (Electromactra) ovalina* Lamarck, *M. (Telemactra) abbreviata* Lamarck, *Spisula (Notospisula) trigonella* Lamarck (no living specimens seen from South Australia), *Anapella cycladea* Lamarck (= *Mactra pinguis* Crosse and Fischer), *Labiosa meridionalis* Tate. *Mactra amygdala* Crosse and Fischer, described from Spencer Gulf, appears to be merely the juvenile of *M. pura* Reeve. *Mactra adelaidae* Angas.

To the Western Australian list may be added: *M. jacksonensis* Smith, Albany to Bunbury, down to 35 fath. *M. ovalina* Lamarck, Albany to Bunbury, to 22 fath.

FAMILY AMPHIDESMATIDAE.

Only three species are taken in South Australia: *Amphidesma* (= *Amesodesma* Iredale 1930) *angustata* Reeve, *A. cuneata* Lamarck, *A. nitida* Reeve.

A. erycinaea Lamarck has been erroneously listed from South Australia, but does not occur here.

FAMILY HIATELLIDAE.

South Australian species are: *Hiatella australis* Lamarck, *angasi* Angas, *Panope australis* Sowerby. *H. subalata* Gatliff and Gabriel was taken at the following localities: Corny Point, 3 miles south of Tunk Head, 16 fath., mid-channel between Cape Borda and Wedge Island, 60 fath. As pointed out by Iredale, this is apparently more nearly related to the *Eximiothracia-Phragmorisma* series than to *Hiatella*. *H. australis* Lamarck was taken in Western Australia at Albany, Yallingup, Ellensbrook, Bunbury, and Fremantle.

FAMILY GASTROCHAENIDAE.

Two species occur in South Australia, *Gastrochaena tasmanica* Tenison-Woods and *G. frondosa* sp. nov., recorded by previous authors as *G. lamellosa* Deshayes, a Philippine Island species different in shape from ours.

GASTROCHAENA FRONDOSA sp. nov.

Fig. 1 and 2.

Fairly solid, inflated, leaf-like in shape, very widely gaping, umbos but slightly prominent, rounded behind, sharply rounded in front; ventral margin convex throughout its length; yellowish-white (cotype is darker, brown), bluish within; sculpture of numerous delicate concentric lamellae, crowded in front, spaced behind; hinge with the vestige of a cardinal tooth and corresponding socket, and an obsolete posterior lateral; ligament external, posterior, small.

Holotype. Height 15·5 mm., length 33 mm., breadth across joined valves 14·5 mm. Backstairs Passage, 35 fath., burrowing in a sponge. D. 10968. Also Investigator Strait, 10 miles of Troubridge, Hardwicke Bay, 8 fath.; Port Adelaide Creek, burrowing in limestone; and Point Marsden, 17 fath.

The nearest described species seems to be *G. gigantea* Deshayes from unknown locality. Our shell differs from this in the general shape of the shell, particularly the ventral margin.

FAMILY TEREDIDAE.

Species recorded from South Australia are: *Teredo pocilliformis* Moll and Roch, *T. calmani* Moll and Roch, *T. (Pingoteredo) fragilis* Tate, *T. (Nototeredo) edax* Hedley. *Bankia gabrieli* sp. nov. A scientific investigation of this family

has yet to be made in South Australia, when probably more species will be found to occur.

BANKIA GABRIELI sp. nov.

Fig. 5, 6, and 7.

Shell of medium size, white; anterior auricle large, sculptured with very numerous riblets; posterior auricle small, elongate, smooth, except for accremental striae; median area medium in size; anterior median fairly broad, extremely closely marked with fine riblets; middle median narrow; posterior median narrow, smooth but for fine accremental striae; interior ivory-white; knob small, circular, detached; blade thin, arising from behind the umbones; shelf elevated as a ridge running towards the umbones, not meeting the blade; hinge thick, umbones fairly large. Pallets (fig. 6) consisting of cone-in-cone elements, well separated, numbering six, edges smooth; sinuate on one side, not sinuate on the other. Stalk long and thin, slightly longer than the cone-in-cone portion.

Holotype. Shell, height 7 mm., length 6·8 mm. Pallet, length 10·5 mm., length of stalk only 5 mm., width of cone-in-cone section 1·9 mm. Dennekin Slip, Port Adelaide. In South Australian Museum (D. 10970).

The pallets of the holotype have a small fragment broken from each end, so that the measurements of a complete paratype pallet is given here. Paratype pallet (largest specimen) : Length 20·5 mm., length of stalk only, 11 mm., width of cone-in-cone section 2·1 mm.

The specimen described as holotype was handed to me by Mr. C. J. Gabriel, after whom it is named. According to our investigations it would seem that Cobra or Shipworms are scarce in the Port Adelaide River.

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2. Marwick : Trans. N.Z. Inst., 57, p. 613 (1927).
3. Sowerby : Sowerby's Genera of Shells, pl. 72 (1826).
4. Reeve : Conch. Icon., xiv, Circe (1864), pl. 1, fig. 3a.
5. Iredale : Mem. Qld. Mus., ix, pt. iii, p. 267 (June 29, 1929).

A REVISION OF THE TROMBID AND ERYTHRAEID MITES OF AUSTRALIA WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

By H. WOMERSLEY, F.R.E.S., A.L.S., Entomologist, South Australian Museum.

Fig. 1-235.

The two families of Acarina dealt with in this paper are very closely related; both belong to the suborder Prostigmata, characterized by the position of the stigmata, which open at the base of the mandibles in the adults.

In general appearance the members of both families are similar, but in the Erythraeidae the mouth-parts are more or less retractile, while in the Trombidiidae they are not so. In the larval forms the Trombidiidae have a stigmal opening between the first and second coxae.

Several species of Trombidiidae are of economic importance, for their larvae are not only of great annoyance to man, but transmit disease. In Japan the Kedani or river fever is caused by the bite of the Akamushi (*Microtrombidium akamushi* Brumpt.), while in Queensland and the Coorong district of South Australia the ti-tree itch mite (*Trombicula hirsti* Sambon) is a source of irritation to campers. The harvest mites of Europe comprise the larval forms of several species; similarly in America other species are regarded as pests. Other larval Trombids, while not attacking man, are pests of various animals, such as cats, rodents, and marsupials, and are generally to be found in the ears, on the scrotum, etc. Adult Trombids, as far as is known, feed upon insects and their eggs.

As far as is known none of the Erythraeidae attacks man or animals, but all species are essentially parasites of the early stages of insects. The adults probably have similar habits to the adults of the Trombidiidae.

In studying these creatures one is faced with the difficulty that only in one or two cases have the life-histories been to any extent worked out, and is forced to give both generic and specific names to larval forms without any correlation with the adults.

Comparatively little work on this section of the fauna has been carried out in Australia, only four workers having written on them, namely, W. J. Rainbow, N. Banks, S. Hirst, and L. W. Sambon. Most of our knowledge is due to the work of Mr. S. Hirst, who was in South Australia during the years 1927-1928.

In 1906 W. J. Rainbow ([14]) listed two species of Trombidiidae, *Trombidium sericatum* sp. nov. and *Trombidium papuanum* Canestrini. In this paper the first-named is referred to the genus *Caenothrombium* of Oudemans, and is shown to be synonymous with two of Hirst's later species. I have not been able to see the original description of the second species, but as Berlese, in his monograph of the group ([3]), does not mention it, probably it is not recognizable now and can be dropped. In addition Rainbow records three occurrences of "*Leptus* spp." on various insects. It is possible that these do belong to the genus *Leptus* (Erythraeidae) as now understood, especially considering their hosts; almost certainly they should not be placed in the Trombidiidae. Amongst the Erythraeidae Rainbow lists *Smaridia extranea* Koch from Queensland, *Rhyncholophus montana* sp. nov. from Mount Kosciusko, and *Rhyncholophus celeripes* sp. nov. from Enfield, N.S.W. I have not seen the original description of the first, and do not discuss it in this paper. The second is shown herein to be a species of *Caeculisoma*, and the third a species of *Erythraeus*.

The next paper was by Banks ([2]), who described a number of Acarina taken in association with ants by the late Mr. A. M. Lea in Victoria and Tasmania. Amongst the Trombidiidae he described *Trombidium aequalis*, which is referable to *Microtrombidium*, as are also *Rhyncholophus attolus* and *R. retentus*, which he refers to the Erythraeidae. *Fessonia prominens* Banks is a true member of the Erythraeidae, but the genus must be changed to *Calyptostoma*.

The first of Hirst's papers dealing with the Australian species was that in the Annals and Mag. Nat. Hist. for 1926 ([6]), when he described the following species: *Allothrombium terraereginae*, *Allothrombium (Mesothrombium) antipodianum*, *A. (M.) a.* var. *olorinum*, all belonging to the Trombidiidae. In the same journal for 1928 ([8]) he added the following species: *Chyzeria australiense* sp. nov., *Neotrombidium barringunense* sp. nov., *Diplothrombium australiense* sp. nov., *Microtrombidium barringunense* sp. nov., *Microtrombidium (Enemothrombium) collinum* sp. nov., *M. (E.) wyandrae* sp. nov., *Dinothrombium nynganense* sp. nov., *D. splendidum*, sp. nov., *D. torridum* sp. nov., *D. crassum* sp. nov., and *Allothrombium wyandrae* sp. nov. amongst the Trombidiidae; and *Caeculisoma nasutum* sp. nov., *Leptus pilosus* sp. nov., *L. reginae* sp. nov., *L. antipodianus* sp. nov., *L. imperator* sp. nov., *Micromaris goannae* sp. nov., and *Belaustium warregense* sp. nov. amongst the Erythraeidae. Of the above all his species of *Dinothrombium* are placed herein in the genus *Caenothrombium*, and *D. splendidum* is regarded as a synonym of *C. sericatum* (Rainbow). The species of *Leptus* are now placed under *Erythraeus*, and *L. imperator* and *L. antipodianus* are included in the synonymy of other species. *Belaustium warregense* is a member of the genus *Leptus* as now defined.

In the Proc. Zool. Soc. London for 1928 (9) Hirst listed the following: *Chyzeria montana* sp. nov., *C. musgravi* sp. nov., *Microtrombidium paranum* sp. nov., *M. affine* sp. nov., *M. montivagum* sp. nov., *M. (Enemothrombium) koordanum* sp. nov., *M. (E.) simile* sp. nov., *Allothrombium guttatum* sp. nov., *A. ornatum* sp. nov., *A. insigne* sp. nov., *A. antipodianum* var. *kondinium* var. nov., *Dinothrombium rainbowi* sp. nov., *D. ventricosum* sp. nov., *D. nobile* sp. nov., *D. augustae* sp. nov., and *D. taylori* sp. nov. belonging to the Trombidiidae. Of these *C. musgravei* is reduced in this paper to varietal rank; *M. montivagum* is placed in the genus *Caenothrombium,* and *D. rainbowi* is considered synonymous with it. *Allothrombium ornatum* is treated as a synonym of *A. guttatum, D. ventricosum* of *C. sericatum* (Rainbow), and *D. taylori* of *C. torridum. Allothrombium insigne* is placed in the new genus *Austrothrombium,* as is also *A. antipodianum* var. *kondinium,* which is shown not to be related to *A. antipodianum.*

In the same journal for 1929 (10) Hirst added to the list *Chyzeria armigera* sp. nov., *C. insulana* sp. nov., *C. occidentalis* sp. nov., *Trombella warregensis* sp. nov., *Allothrombium (Mesothrombium) australiense* sp. nov., *A. parvulum* amongst the adult Trombidiidae, and *Trombicula novae-hollandiae* sp. nov., *Schongastia dasycerci* sp. nov., and *S. antipodianum* sp. nov. amongst the larval forms. He suggested that *C. occidentalis* might be only a variety of *C. australiense,* and I agree with this view.

In the Annals and Mag. Nat. Hist (15), 1927, Dr. L. W. Sambon described a larval Trombid from Queensland as *Trombicula hirsti,* while in the same publication for 1929 Hirst recorded this species for South Australia, and described another larval form under the name of *Schongastia coorongense.*

The previous known adult species of Trombid and Erythraeid Mites from Australia, therefore, omitting one or two doubtful forms, as well as those herein regarded as synonyms or reduced to varietal rank, are as follows:

Adult Trombidiidae, 32 species and 2 varieties.
Larval Trombidiidae, 5 species.
Adult Erythraeidae, 9 species.
Larval Erythraeidae, nil.

In the present paper 46 species and 4 varieties of adult Trombidiidae are listed, of which 2 genera, 14 species, and 1 variety are new. Of the larval Trombidiidae 2 new species are added. In the Erythraeidae 24 adult forms are listed, of which 14 species and 1 genus are new. No larval Erythraeids have been previously recorded from Australia, but no fewer than 9 species are now described.

The writer is grateful to the Authorities of the Australian Museum, Sydney,

for the loan of type material, while his gratitude can hardly be expressed to Professor Harvey Johnston, to whom the material collected by Hirst while in Australia had been given by Mrs. Hirst. This material contains a large number of Hirst's types, the location of which may not have been made known otherwise. These types and many other of Hirst's specimens have been deposited by Professor Johnston in the South Australian Museum. Thanks are also due to many other friends who have collected specimens which have assisted in the preparation of this paper.

FAMILY TROMBIDIIDAE.

CHYZERIA Canestrini, 1897...

CHYZERIA AUSTRALIENSE Hirst, 1928.

The type of this species, from "Swan River, West Australia" is in the South Australian Museum. It is labelled as from the nest of the ant *Ponera lutea*. A second specimen from the same locality is a paratype.

Through the kindness of the Authorities of the Australian Museum, Sydney, I have been able to examine all the types of Hirst's Australian species, with the exception of *C. occidentalis*, and to compare them with a number of additional specimens recently taken in South Australia.

C. occidentalis was described in 1929 (10) by Hirst from a specimen collected on Rottnest Island, West Australia. In his remarks he expressed the opinion that it might only be a variety of *C. australiense*, differing mainly in the shorter and stumpier palpal claws and in the rather more developed lateral body processes. From an examination of all the material before me I quite agree with this view, and in this paper treat it as such.

Further, Hirst's *C. musgravei* must also be considered as a variety differing in that the median anterior plate is developed into a comparatively long process. One specimen amongst the Hirst material in Professor Harvey Johnston's keeping, and now in the South Australian Museum, is clearly intermediate between the two forms in respect of this character, the process being shorter and triangular. This specimen was labelled in pencil by Hirst as *C. musgravei*. All the specimens collected recently by Mr. M. W. Mules and myself in the Adelaide District agree with this intermediate form, for which the name *C. australiense* var. *hirsti* var. nov. is proposed.

Loc. Type: Willunga, West. Aust.; paratypes: Woodside, S. Aust., July, 1933 (W.M.); Mt. Osmond, S. Aust., Sept. 17, 1933 (H.W.); Glen Osmond, S. Aust., Oct. 1, 1933 (H.W.).

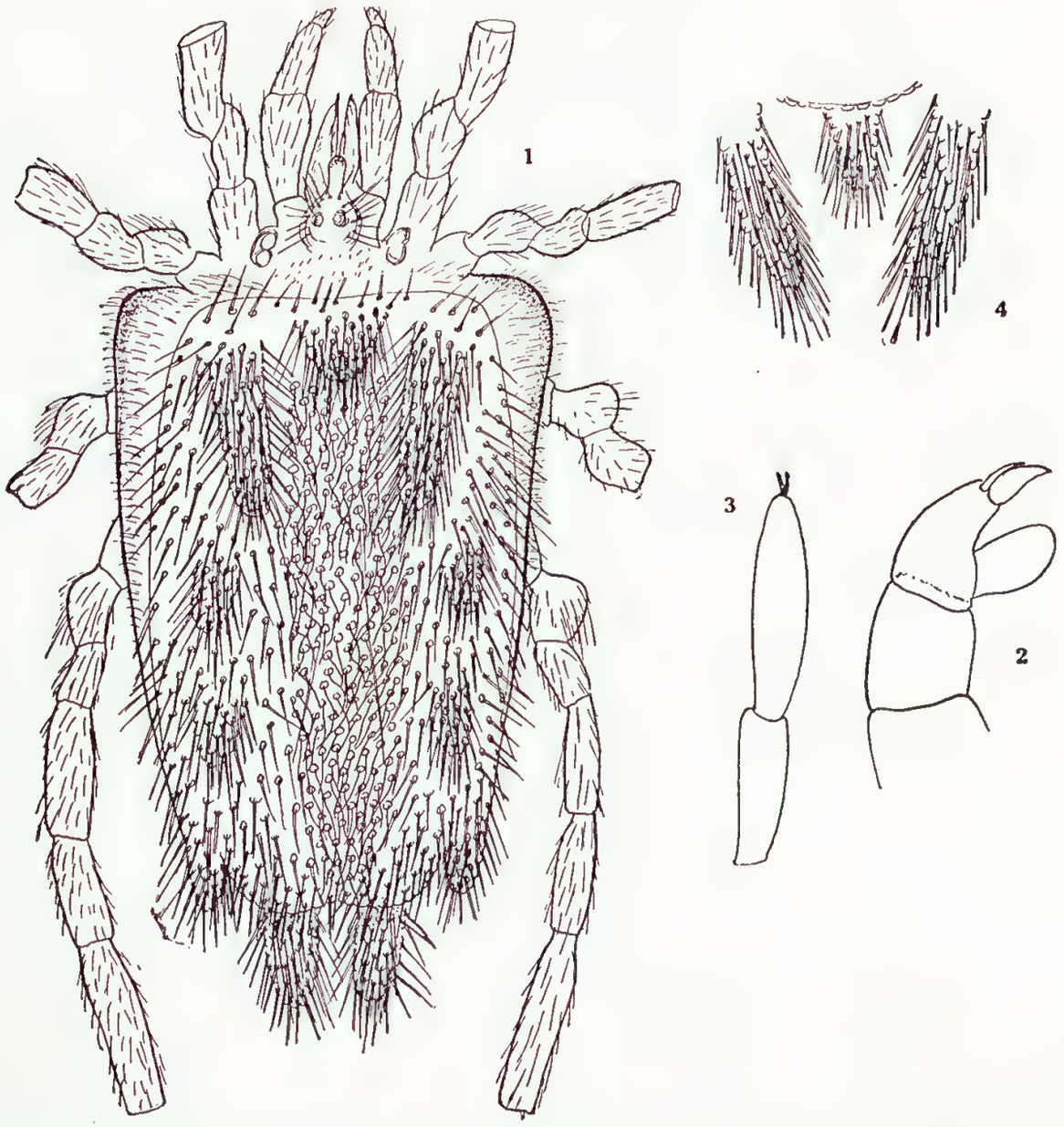

Fig. 1–4. *Chyzeria australiense* Hirst: 1, dorsal view; 2, palp; 3, front tarsus and metatarsus; 4, anterior lateral and medial dorsal prominences of var. *musgravei* Hirst.

KEY TO THE AUSTRALIAN AND NEW ZEALAND SPECIES OF CHYZERIA.

1. Second and third pairs of dorsal lateral processes poorly developed and almost obsolete. No distinct median anterior dorsal process, only a plate with rounded posterior edge. A distinct and comparatively long median process posteriorly and ventrally. Front tarsus rather more than 3 times as long as high and one-fourth as long again as the metatarsus. Palp with comb and long accessory claw.. .. .. *C. australiense* Hirst *f.p.*

   Second and third pairs of dorsal lateral processes distinctly developed .. 2.

2. A triangular or elongate median anterior process present .. .. 3.

   No such process, only a posteriorly-rounded plate .. .. .. 4.

3. With a comparatively long median anterior process.

   C. australiense var. *musgravei* Hirst.

   With a short triangular process antero-medially.

   C. australiense var. *hirsti* var. nov.

4. Terminal claw and accessory claw of palp short and stumpy .. .. 5.

   Terminal and accessory claws of palp long .. .. 6.

5. Unpaired medio-posterior ventral process minute .. *C. insulana* Hirst.

   This process comparatively long and slender.
   C. australiense var. *occidentalis* Hirst.

6. Medio-posterior ventral process minute. Large species. Lateral processes long and with the long ciliated hairs numerous .. *C. armigera* Hirst.

   Medio-posterior ventral process long and slender .. .. .. 7.

7. Anterior lateral pair of dorsal processes long and slender, longer than the next pair. Large species .. .. .. *C. montana* Hirst.

   Anterior pair of lateral dorsal processes little longer than the next pair.
   C. novae-hollandiae Hirst (New Zealand).

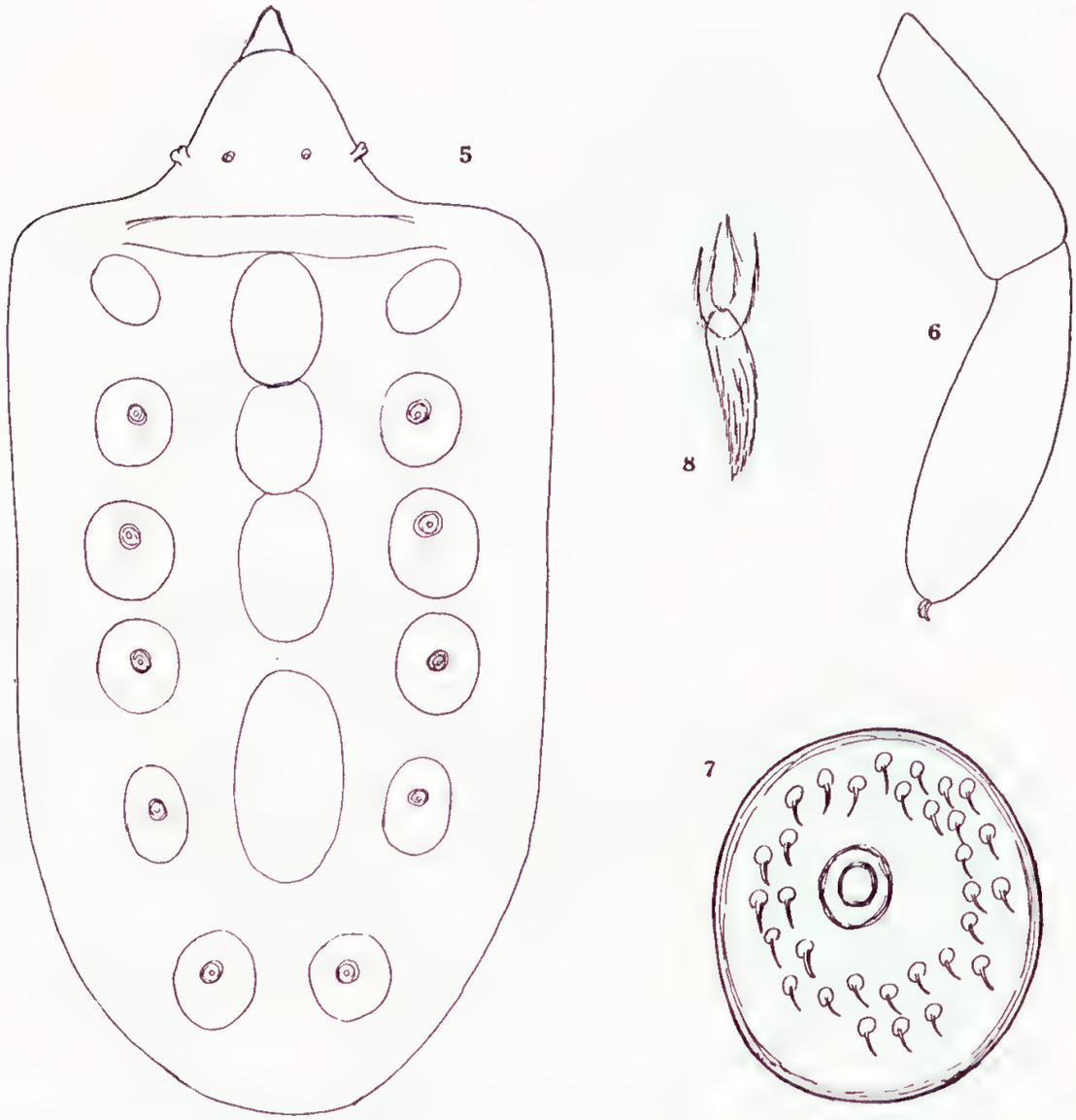

Fig. 5–8. *Trombella warregensis* Hirst: 5, outline of body showing shape and dorsal pits; 6. front tarsus and metatarsus; 7, one of the lateral dorsal pits much enlarged showing setae; 8, one of the setae much magnified.

TROMBELLA Berlese, 1887.

TROMBELLA WARREGENSIS Hirst, 1929.

The type of this species was amongst the Hirst material left in Adelaide, and is now in the South Australian Museum.

The description given by Hirst (10) is very full and adequate, but only the front tarsus and the tip of the palp were figured. A drawing showing the shape of the animal and the general arrangement of the dorsal pits and the spines of the same, together with another figure of the front tarsus and metatarsus, are now given.

The type locality was the River Warrego, New South Wales, August, 1928.

NEOTROMBIDIUM Leonardi, 1901.

NEOTROMBIDIUM BARRINGUNENSE Hirst, 1928.

The type of this species is now in the South Australian Museum. It was found amongst the Hirst material in Adelaide.

There is nothing to add to the original description (8), and the author's

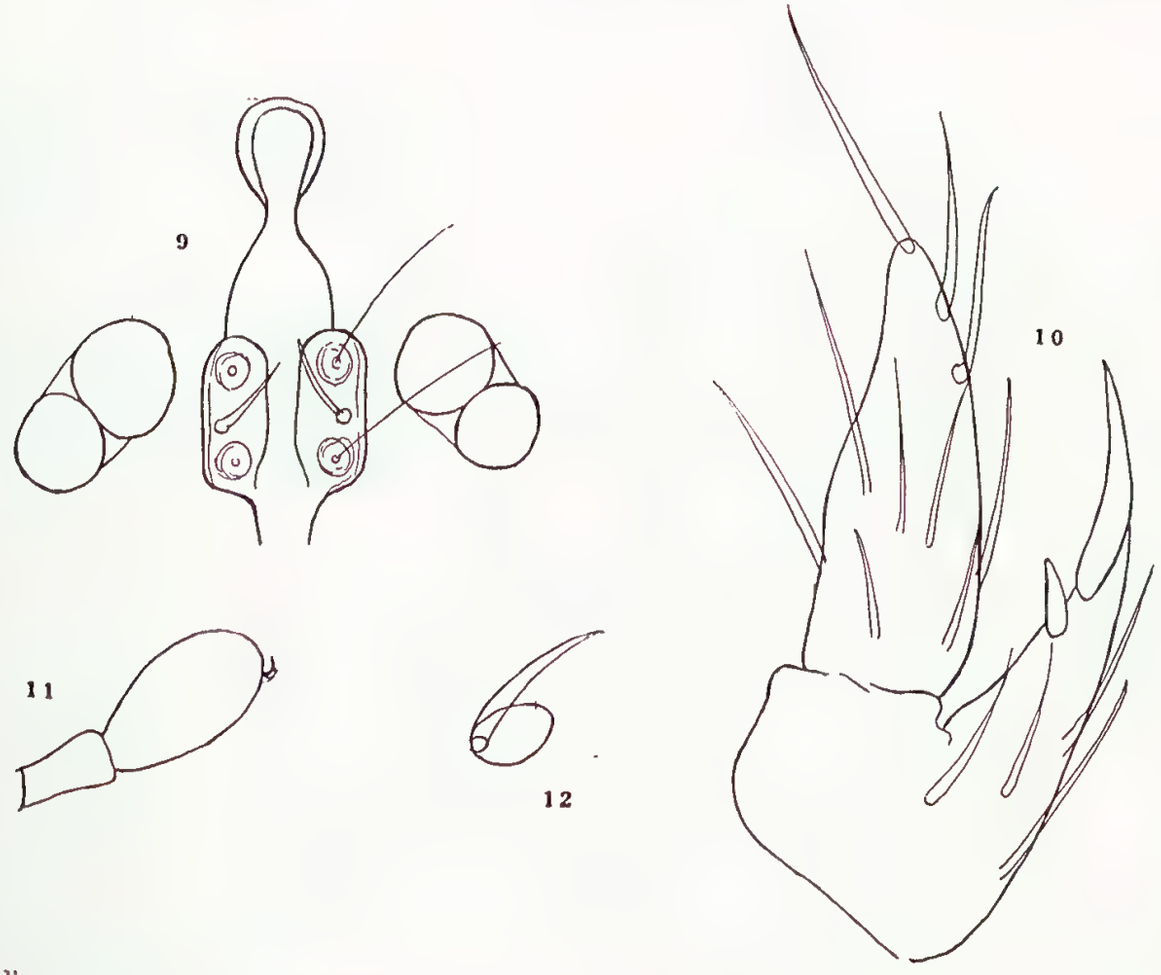

Fig. 9–12. *Diplothrombium australiense* Hirst: 9, crista and eyes; 10, palp; 11, front tarsus and metatarsus; 12, one of the dorsal setae.

figures of the palp, front tarsus and metatarsus and dorsal setae (10) are adequate.

DIPLOTHROMBIUM Berlese, 1910.

DIPLOTHROMBIUM AUSTRALIENSE Hirst, 1928.

This interesting species was described from specimens collected by Hirst at Charlesville, Queensland, in June, 1927 (8). Other specimens were from Gawler, South Australia, in March, 1927. The original description was not accompanied with any figures, but Hirst later (10) figured the front tarsus and metatarsus and the palp.

The syntypes from Charlesville, as well as the Gawler specimen and another from Dubbo, Queensland, were in the Hirst material, and are now in the South Australian Museum.

There is little to add to the original description, but one or two additional details are figured. Hirst's statement that the sensillary area of the crista has three pairs of sensillae is erroneous. The median pair of hairs are not of a sensory nature and do not arise from pits like true sensillae. They are in every respect similar to the ordinary body setae.

MYRMICOTROMBIUM gen. nov.

Diagnosis of Genus: Crista short with two sensillary areas at anterior and posterior ends. One eye on each side, in front of the anterior end of crista. Body as in *Microtrombidium*. Tarsi at end truncate with one or two small raised prominences from which arise plain setae.

Remarks: In having two sensillary areas to the crista this genus comes near to the preceding and also to the genus *Rohaultia* of Oudemans. *Diplothrombium* has the two sensillary areas adjacent and in the middle of the crista. *Rohaultia* has them separated, one being anterior and the other median on a transverse plate. This new genus differs from both in having only a single eye on each side, in this respect resembling *Trombicula*.

Genotype: Myrmicotrombium brevicristatum sp. nov.

MYRMICOTROMBIUM BREVICRISTATUM sp. nov.

Description: Length 0·85 mm. Colour in life pinkish-white. Crista well developed but short, 160 μ, with anterior and posterior sensillary areas each with a pair of sensory hairs about 60 μ long. Eyes, one on each side, large, and placed distinctly in front of the anterior end of crista. Palpi long, with the usual tibial claw, but without accessory claws or spines, palpal tarsus long, not clubbed and well overreaching the tip of claw. Legs shorter than body, II and III shorter than

I and IV, tarsi I and II with two small tubercles on the truncated end, from each of which arises a plain seta, III and IV with one tubercle only, claws strong and simple. Front tarsus 120 μ long and 50 μ high, subelliptical, metatarsus narrower but as long as tarsus. Clothing of numerous densely feathered hairs, the longer ones 35 μ and decidedly bushy, the shorter ones only 15 μ.

Locality: A single specimen collected with ants at Glen Osmond, South Australia, September 11, 1933.

Type: In the South Australian Museum.

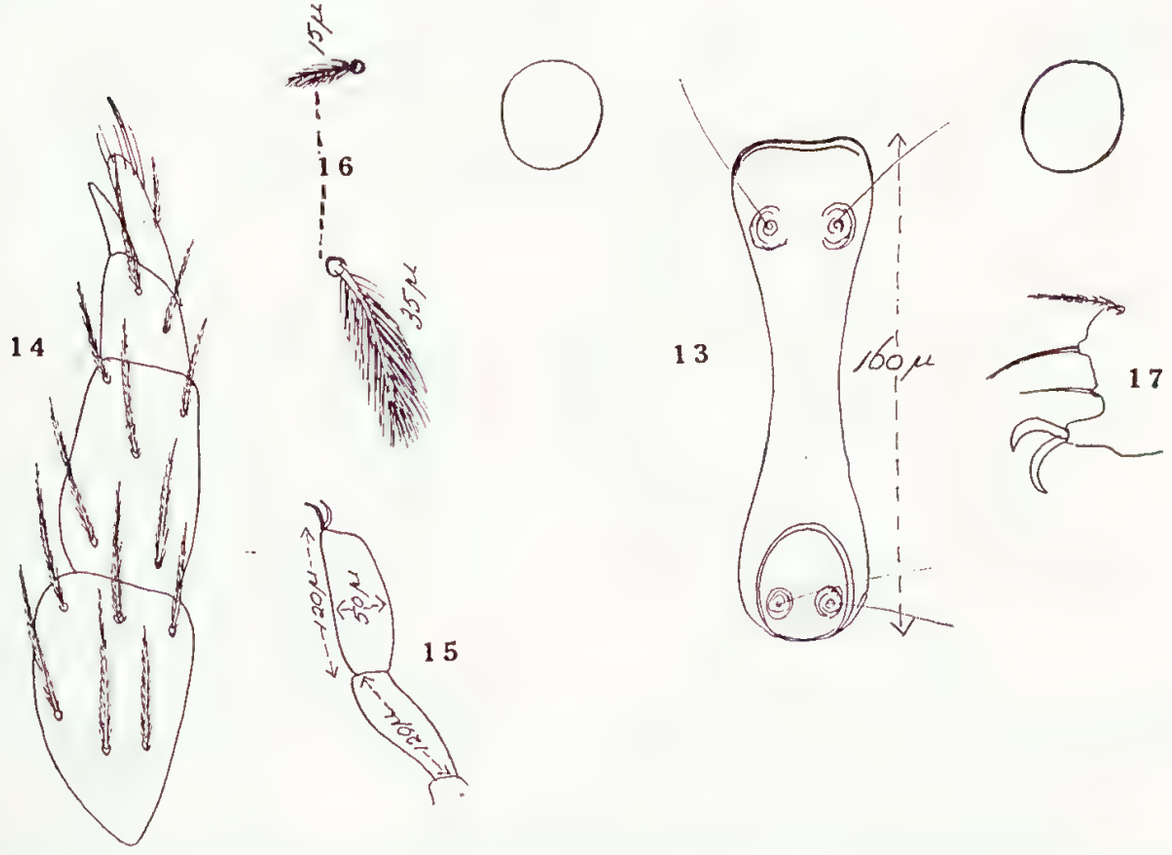

Fig. 13–17. *Myrmicotrombium brevicristatum* n.g., n.sp.: 13, crista and eyes; 14, palp; 15, front tarsus and metatarsus; 16, dorsal setae of two sizes; 17, tip of tarsus and claw.

MICROTROMBIDIUM Haller, 1882.

This genus as it is represented in Australia is composed of the two subgenera *Enemothrombium* and *Microtrombidium* s. str. It is particularly rich in species, no fewer than 19 being now listed for this continent.

MICROTROMBIDIUM Haller, 1882, s. str.

MICROTROMBIDIUM BARRINGUNENSE Hirst, 1928.

The type of this species was amongst the material left by Hirst, and is now deposited in the South Australian Museum. There is nothing further to add to

the original description (8), and the species may be identified by the key given in this paper.

MICROTROMBIDIUM WESTRALIENSE sp. nov.

Description: Closely allied to the preceding species. Size 1·2 mm. Body shape normal. Eyes two on each side, almost sessile (when first mounted the eyes were easily observed, but owing to displacement of the specimen they cannot now be seen, being hidden by the legs). Sensillary area of crista posterior in position. Nasal process wanting. Dorsal hairs uniform, long, 60 μ, and feathered as in *M. barringunense* Hirst. Ventral hairs similar but shorter and slightly stouter, 25 μ. Palpal tibia with the usual terminal claw and its base on inside with two smaller accessory claws or spines much as in preceding species. Palpal tarsus not clubbed, barely reaching tip of claw. Tarsus of front legs elongate, sides slightly tapering towards apex, 200 μ long by 90 μ high, one-third as long again as metatarsus. Colour of animal in life red.

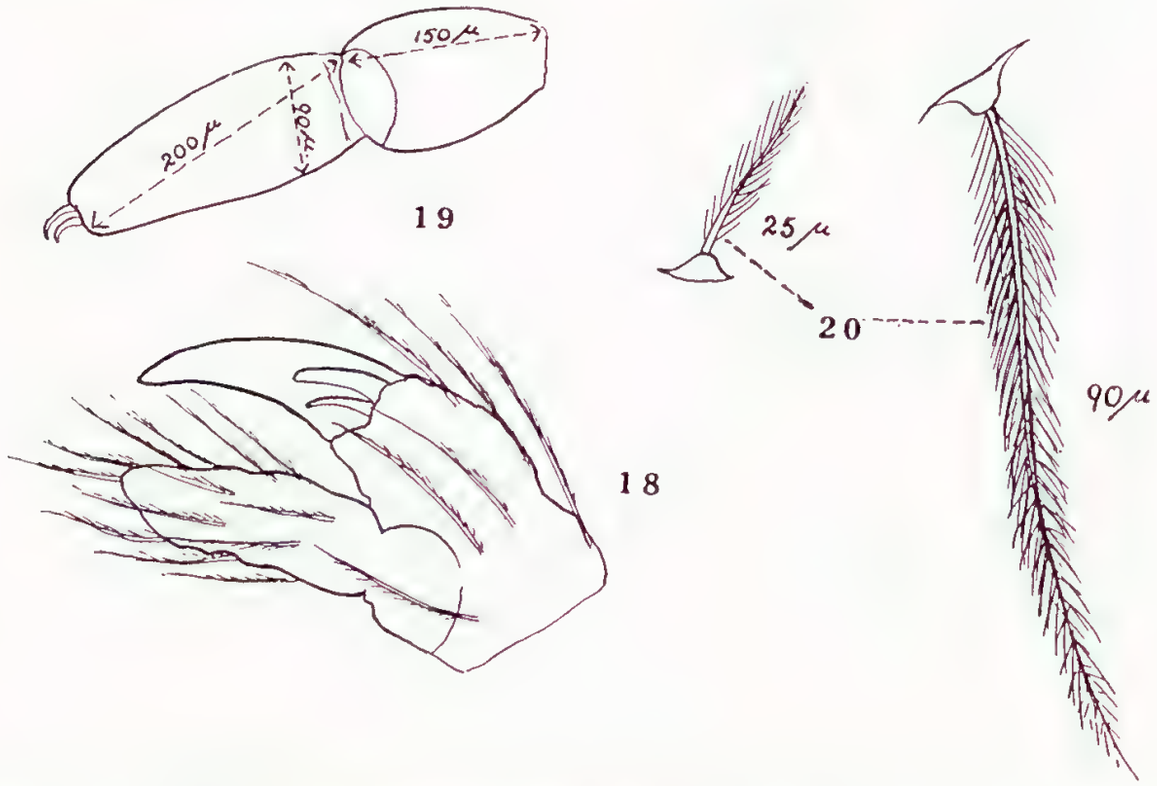

Fig. 18–20. *Microtrombidium westraliense* n.sp.: 18, palp; 19, front tarsus and metatarsus; 20, long and short dorsal setae.

Locality: Under stones at Mundaring, West Australia, August 9, 1931 (H.W.).

Type: In the South Australian Museum.

Remarks: This species differs from the preceding species in the presence of eyes and in the dimensions of the front tarsus.

MICROTROMBIDIUM MYRMICUM sp. nov.

Description: Size 0·8 mm. Body of normal shape, broadest across the shoulders. Eyes two on each side, sessile. Crista with posterior sensillary area. Dorsal hairs all of one type, leaf-like with short lateral hairlets, almost as broad as long, length 20 μ. Palpal tibia with terminal and one accessory claw followed by four

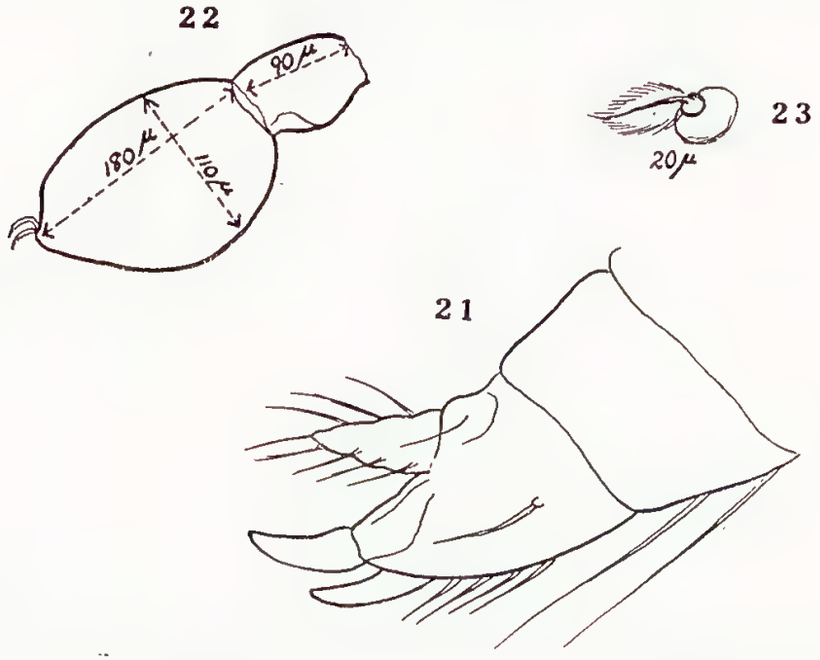

Fig. 21–23. *Microtrombidium myrmicum* n.sp.: 21, palp; 22, front tarsus and metatarsus; 23, one of the dorsal setae.

or five spines. Palpal tarsus small, not clubbed, and not reaching tip of claw. Tarsus of front leg short, elliptical, more than half as high as long, 110 μ by 180 μ respectively, twice as long as metatarsus. Colour in life light red.

Locality: With ants, Mundaring, West Australia, May 25, 1931 (H.W.).

Syntypes: In the South Australian Museum.

MICROTROMBIDIUM ATTOLUS (Banks, 1916).

Syn. *Rhyncholophus attolus* Banks, 1916.

The species described by Banks (2) as *Rhyncolophus attolus* is, like his species *R. retentus*, a member of the genus *Microtrombidium* s.l. The syntypes are in the South Australian Museum. Although Banks states that the eyes are two on each side it is not possible to see any in the remounted specimens. In the South Australian Museum collections were found two other specimens mounted dry on cards from the same locality, and although these have been cleared and mounted still no eyes are to be seen. As Banks was also wrong in his determina-

tion of the eyes in his other species it seems possible that he was also in error in this case. *Microtrombidium attolus* can be separated from all other species by the key. It comes closest to *M. barringunense* Hirst, in the absence of eyes, but

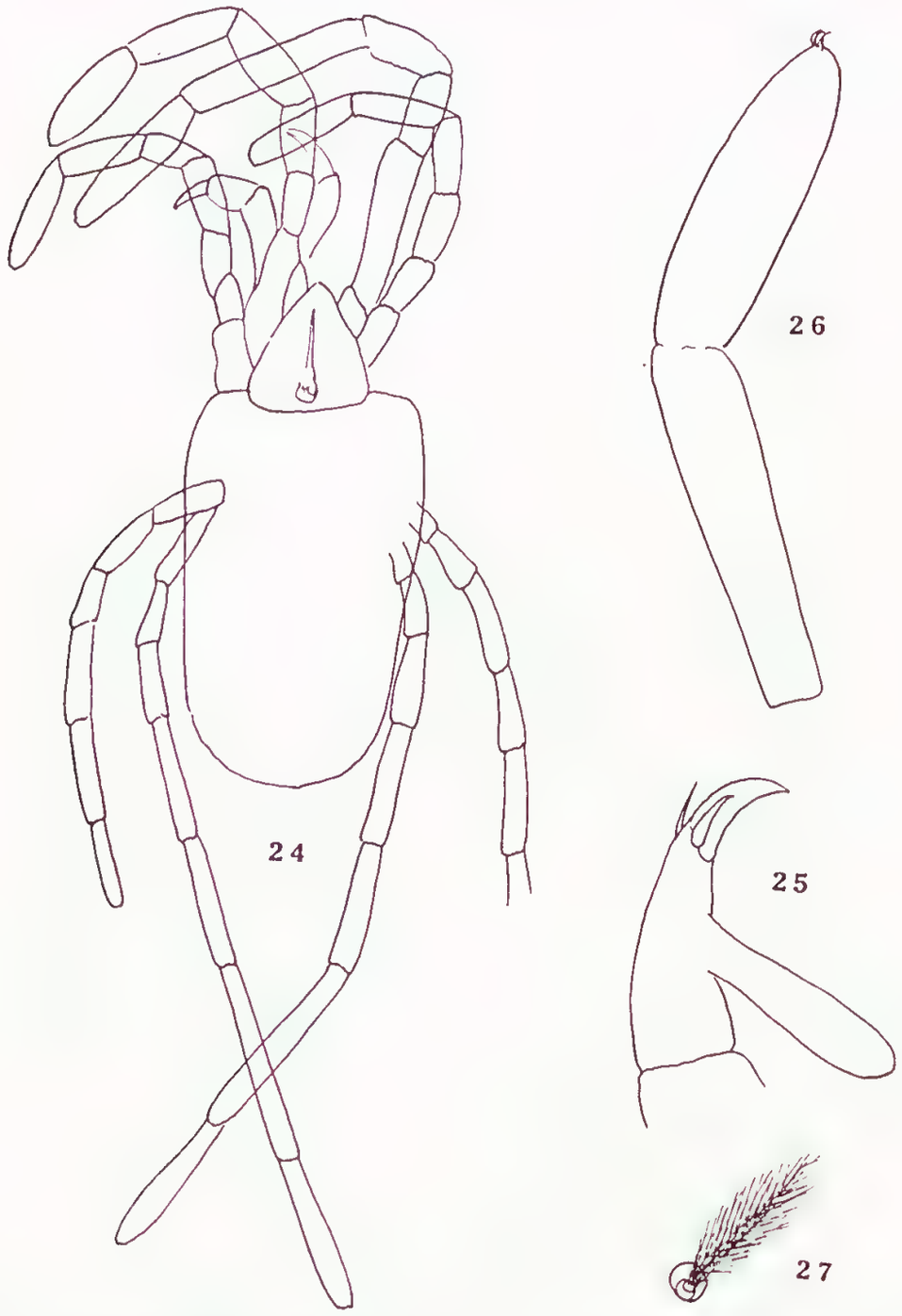

Fig. 24–27. *Microtrombidium attolus* (Banks): 24, entire animal in outline; 25, palp; 26, anterior tarsus and metatarsus; 27, dorsal seta.

differs from it in the proportions of the front tarsi and the number and structure of the dorsal body hairs. The mandibles are of the normal Trombid type, and not of the Erythaeid. An outline of the entire animal, and details of the palp, front tarsi, and dorsal hairs are given.

MICROTROMBIDIUM AEQUALIS (Banks, 1916).

Syn. *Trombidium aequalis* Banks, 1916.

The type of this species does not appear to be in the South Australian Museum, and was possibly not returned after determination. The original description and figures given by Banks ([2]) are extremely good, but the species is obviously a *Microtrombidium* and not a *Trombidium*. A single specimen taken by myself at Greenbushes, Western Australia, on August 28, 1931, is referred to this species.

MICROTROMBIDIUM PARANUM Hirst, 1928.

The type was amongst the Hirst material left in Adelaide, and is now in the South Australian Museum.

MICROTROMBIDIUM AFFINE Hirst, 1928.

Hirst's type is in the South Australian Museum, together with two specimens collected by myself at Adelaide in 1933.

In his description ([9]) Hirst refers to a small comb of teeth behind the apical and accessory claws of the palp. As the palp was mounted in a bad position for observing this comb, it has been remounted, and it can now be seen that the comb consists of a graduated series of teeth. In the presence of this comb and the shape of the front tarsus it differs markedly from *M. barringunense* Hirst, with which the author contrasts it. From *M. paranum* Hirst it can be separated by the characteristic hairs of the dorsum.

MICROTROMBIDIUM KARRIENSIS sp. nov.

Description: Size 1·0 mm. Colour reddish. Body of normal shape. Eyes two on each side, sessile. Crista with posterior sensillary area. Dorsal hairs uniform, short, 35 μ, with long accessory hairlets, which are very much longer than those in the nearest species, *M. affine* Hirst. Palpal tibia with large claw, smaller accessory claw, and a series of 6–7 strong spines. Palpal tarsus not clubbed, long, and reaching tip of claw. Tarsus of front leg elliptical, less than twice as long as high, 270 μ by 155 μ respectively, metatarsus short, as long as tarsus is high. Front legs as long as body.

Locality: Denmark, West Australia, July 6, 1932 (H.W.).

Type: In the South Australian Museum.

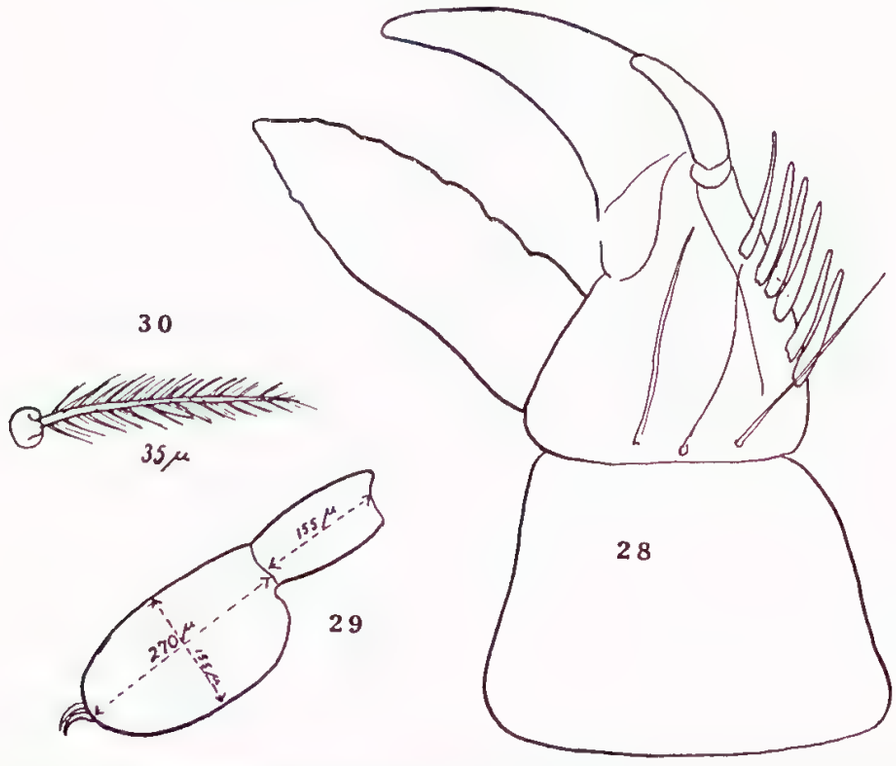

Fig. 28–30. *Microtrombidium karriensis* n.sp.: 28, palp; 29, front tarsus and metatarsus; 30, dorsal seta.

MICROTROMBIDIUM SPINATUM SP. NOV.

Description: Length 1·4 mm. Colour reddish. Crista in the type specimen indeterminate owing to displacement. Eyes similarly indeterminate. Palpi as figured, with one large accessory tooth after the claw, followed by two large spine-like setae. Palpal tarsus clubbed but not reaching tip of claw. Legs all shorter than the body, front tarsus 270 μ long by 135 μ high, metatarsus 190 μ long. Body hairs very numerous, spine- or rod-like, with only small, fine, and indistinct adjacent hairlets, length of spines somewhat variable in length, from 50 μ to 150 μ, but mostly the latter, and all of the same type.

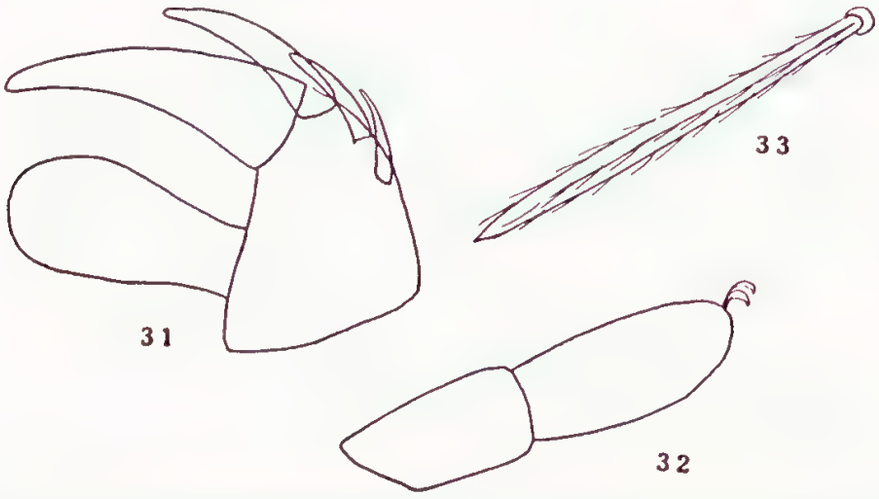

Fig. 31–33. *Microtrombidium spinatum* n.sp.: 31, palp; 32, front tarsus and metatarsus; 33, dorsal seta.

Locality: Glen Osmond, South Australia, October 1, 1933 (H.W.).

Type: In the South Australian Museum.

Remarks: This species comes very close to *M. (Enemothrombium) victoriense* sp. nov., but differs in that the dorsal hairs are of uniform type.

ENEMOTHROMBIUM Berlese, 1912.

MICROTROMBIDIUM (ENEMTHROMBIUM) RETENTUS (Banks, 1916).

The syntypes of this species are in the South Australian Museum. Hirst in 1928 (9) pointed out that this species belonged to the Trombidiidae, and not to the Erythraeidae, in which it was placed by Banks. As the specimens have been

Fig. 34–37. *Microtrombidium (Enemothrombium) retentus* (Banks): 34, crista and eyes; 35, palp; 36, front tarsus and metatarsus; 37, larger and smaller dorsal setae.

remounted for further examination it can now be definitely placed in the subgenus *Enemothrombium* of *Microtrombidium*. The following additional details can be given. Eyes two on each side (not one, as stated by Banks), sessile. The dorsal body hairs are of two kinds, a longer type 50 μ long, fairly thick, and somewhat clavate distally (in many the distal portion is bi- or even tri-furcate). The smaller hairs are short, fairly thick, not distinctly pointed apically, and with long hairlets. The palpal tibia has the usual claw and three or four stout spines behind (cf. fig.). The palpal tarsus is large, tapering distally, and overreaching tip of claw. The tarsus of front legs is elongate, parallel-sided, and four times as long as high, 360 μ and 90 μ respectively, metatarsus 315 μ long.

MICROTROMBIDIUM (ENEMOTHROMBIUM) ADELAIDICUM sp. nov.

Description: Size 1·0 mm. Colour red. Body of normal shape, broadest across shoulders. Eyes two on each side, sessile. Crista with sensillary area at about one-third from posterior end. Dorsal hairs of two kinds, a larger type 50 μ long, scattered evenly over the whole surface, with long hairlets, and although with parallel sides rather pointed at the apex. The shorter hairs are only 20 μ long and pointed, with long hairlets. Palpal tibia with usual claw

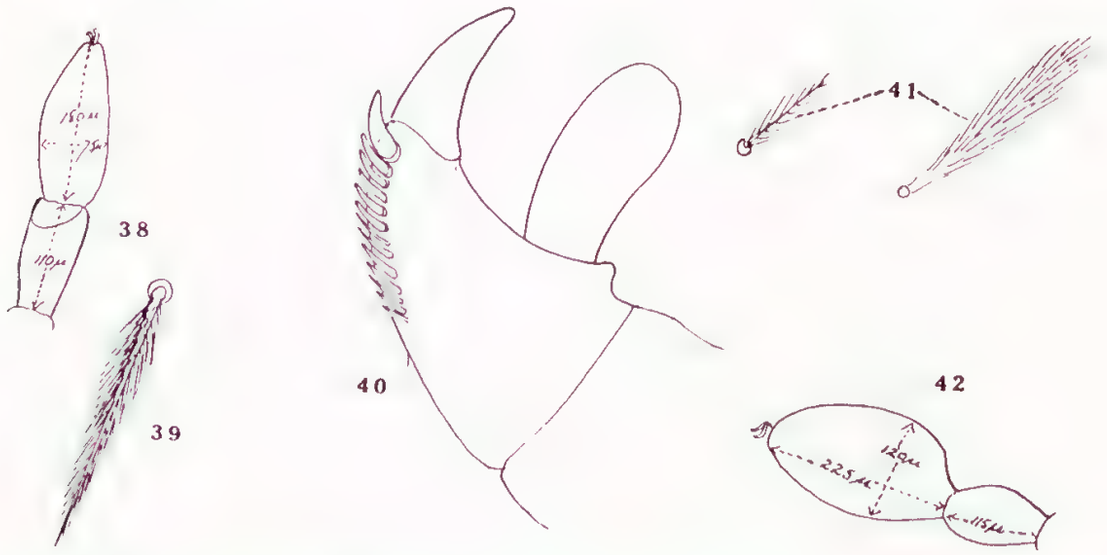

Fig. 38–39. *Microtrombidium (Enemothrombium) adelaidicum* n.sp.: 38, front tarsus and metatarsus; 30, long dorsal hair. Fig. 40–42. *Microtrombidium (Enemothrombium) newmani* n.sp.: 40, palp; 41, long and short dorsal hairs; 42, front tarsus and metatarsus.

followed by accessory claw, then a series of 10–13 strong spines. Palpal tarsus not clubbed. Tarsus of front leg elliptical, more than twice as long as high, 180 μ and 75 μ respectively, slightly more than half as long again as metatarsus.

Locality: In ants' nest, Glen Osmond, South Australia, September 10, 1933 (H.W.).

Syntypes: In the South Australian Museum.

MICROTROMBIDIUM (ENEMOTHROMBIUM) NEWMANI sp. nov.

Description: Size 1·0 mm. Colour red. Body of normal shape. Eyes two on each side, sessile. Crista with posterior sensillary area. Dorsal body hairs of two types, the longer ones clavate, with numerous hairlets, 70 μ long, the shorter ones 20 μ long, with fairly long hairlets. Palpal tibia with normal claw followed by a graduated series of spines. Palpal tarsus clubbed, much longer than and overreaching tip of claw. Front tarsus elliptical, 225 μ long by 120 μ high, twice as long as metatarsus. Front legs shorter than body.

Locality: Bedford-dale, West Australia, November 29, 1932 (H.W.).

Type: In the South Australian Museum.

This species is named in honour of Mr. L. J. Newman, Government Entomologist of West Australia.

MICROTROMBIDIUM (ENEMOTHROMBIUM) KOORDANUM Hirst, 1928.

The type of this species was found amongst the Hirst material in Adelaide, and is now in the South Australian Museum.

MICROTROMBIDIUM (ENEMOTHROMBIUM) SIMILE Hirst, 1928.

The type material of this species, taken by Hirst in the National Park, Belair, South Australia, was amongst the material left in Adelaide, and is now in the South Australian Museum. In the National Museum, Sydney, are three specimens in spirit, and a slide of the chelicerae and palpi, the locality for which is Myall Lakes, New South Wales (A. Musgrave, 1922).

MICROTROMBIDIUM (ENEMOTHROMBIUM) COLLINUM Hirst, 1928.

Hirst's type was also amongst the material left in Adelaide, and is now in the collections of the South Australian Museum.

MICROTROMBIDIUM (ENEMOTHROMBIUM) WYANDRAE Hirst, 1928.

The type, found amongst his Adelaide material, is now in the South Australian Museum.

MICROTROMBIDIUM (ENEMOTHROMBIUM) VICTORIENSE sp. nov.

Description: Length 2·6 mm. Colour red. Eyes two on each side, sessile. Crista with posterior sensillary area and with a row of strong setae on each side of anterior portion. Front tarsus two and a half times as long as high and one-fourth as long again as metatarsus. Palpal tibia with strong terminal claw, an outer claw at base of this, and another claw inside. There are also two distinct series of spine-like setae on the outside of the palpal tibia. Palpal tarsus slightly overreaching tip of claw, not clubbed. Dorsal body hairs of two forms; some very long and spine-like, 200 μ, with very faint indications of small lateral hairlets; others very small and stout, pointed apically, and with hairlets as long as hairs are wide, 20–25 μ long, with bare apex.

Remarks: The type of this species, originally in my collection, and now in the South Australian Museum, was collected by Mr. H. G. Andrewartha at Sassafras, Victoria, in 1931. Amongst the Hirst material left in Adelaide an un-

named preparation, labelled "Mount Gambier, S.A.", without date, can be referred to this species. This preparation is now in the South Australian Museum.

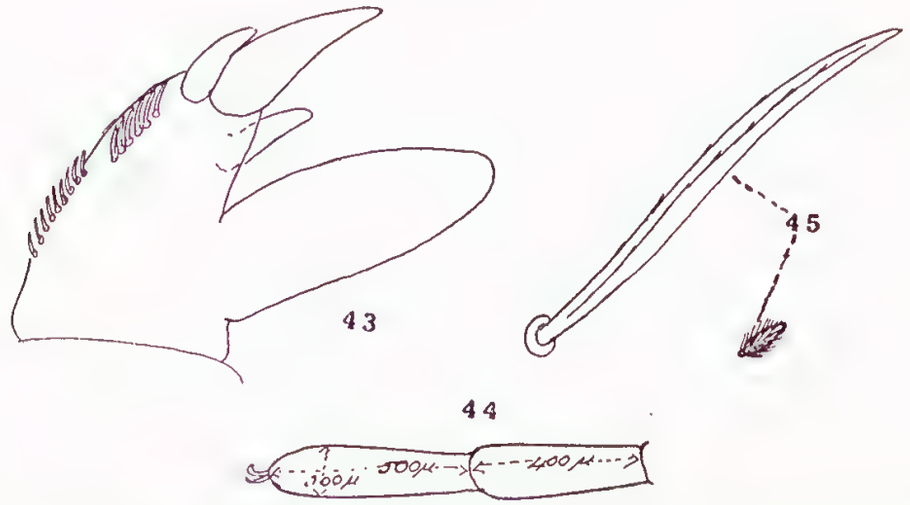

Fig. 43–45. *Microtrombidium (Enemothrombium) victoriense* n.sp.: 43, palp; 44, front tarsus and metatarsus; 45, long and short dorsal hairs.

MICROTROMBIDIUM (ENEMOTHROMBIUM) HIRSTI sp. nov.

Description: Length 1·2 mm. Colour ?. Eyes two on each side, sessile. Crista normal for the genus. Palpi ? (missing in preparation). Front tarsus half as long again as metatarsus and less than three times as long as high. Longer dorsal hairs somewhat cup-shaped, but widening gradually from the base to apex, not sharply expanded as in *M. (E.) simile* Hirst, 60 μ long; smaller hairs cup-shaped, with longer hairlets than in *M. (E.) simile* Hirst, 15–20 μ long.

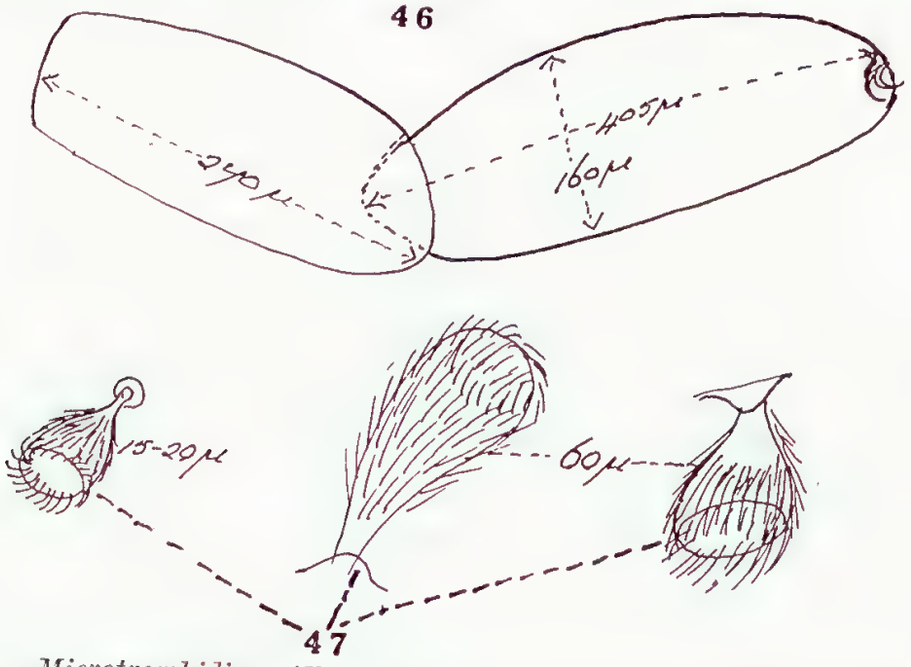

Fig. 46–47. *Microtrombidium (Enemothrombium) hirsti* n.sp.: 46, front tarsus and metatarsus; 47, dorsal hairs.

Remarks: This species is closely related to *M. (E.) simile* Hirst, but differs mainly in the shape of the longer body hairs and in the dimensions of the front tarsus and metatarsus. The type specimen is one found amongst the Hirst material left in Adelaide, and now in the South Australian Museum. It had been labelled *Allothrombium insigne* Hirst in Hirst's writing, but this had been later crossed out in pencil. The locality was Myall Lakes, New South Wales, September, 1922 (A. Musgrave).

MICROTROMBIDIUM (ENEMOTHROMBIUM) SOUTHCOTTI sp. nov.

Description: Length 1·4 mm. Colour in life red. Crista well developed and characteristic of the genus, 245 μ long, with large posterior area which is fur-

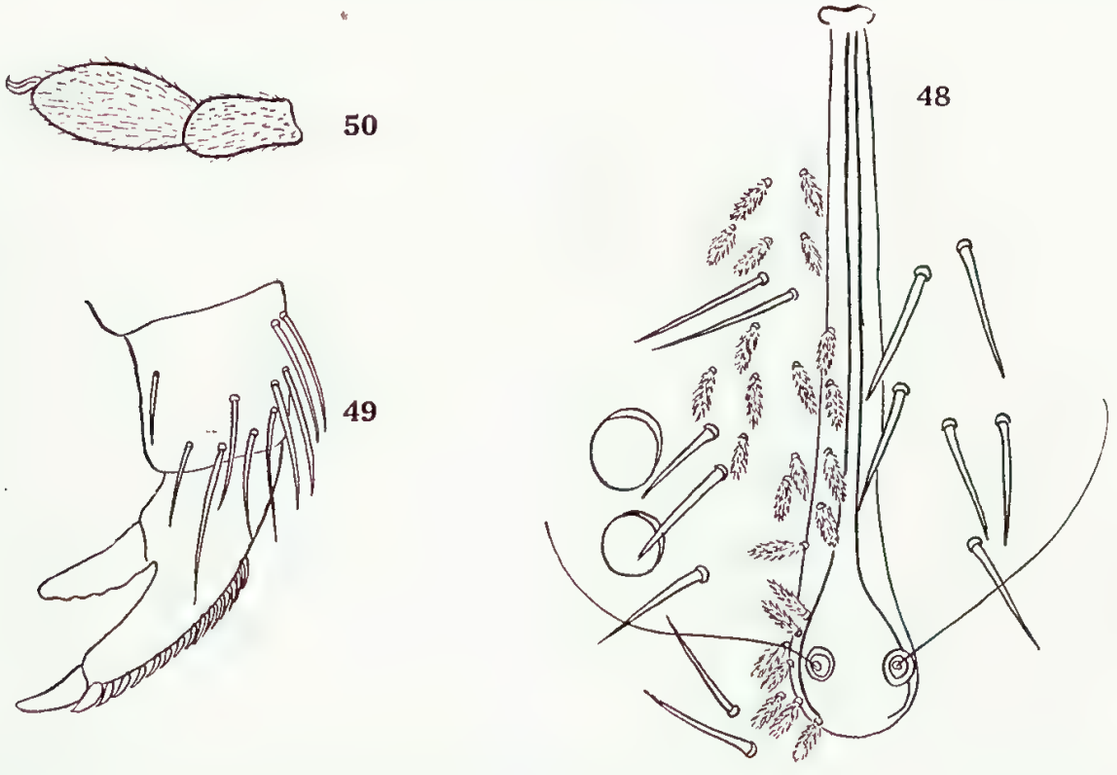

Fig. 48–50. *Microtrombidium (Enemothrombium) southcotti* n.sp.: 48, crista and right eyes; 49, palp; 50, front tarsus and metatarsus.

nished with the usual two sensillary hairs 100 μ long. Eyes, two on each side, sessile, posterior eyes somewhat smaller than the anterior. Palpi as figured, with a fairly strong apical tibial claw followed by a series of teeth on the outer edge which are graduated, gradually becoming spine-like. Legs shorter than body, II and III shorter than I and IV, front tarsus elliptical, 200 μ long by 100 μ high, metatarsus 125 μ long. Clothing of long spines, which are slightly ciliated and 80–82 μ long, and many short ciliated scales 25 μ long. These are parallel-sided, blunt at the tip, and with rather long hairlets. Leg hairs fine, pointed, and ciliated.

Type: A single specimen collected by Mr. R. V. Southcott at Belair, South Australia, January, 1934.

Remarks: This species is very closely related to *M. (E.) victoriense* sp. nov., but differs markedly in the smaller dorsal hairs and in the dimensions of the front tarsus.

KEY TO THE AUSTRALIAN SPECIES OF MICROTROMBIDIUM.

1. Dorsal body hairs of only one type, unmodified .. .. .. 2.
   Subgenus *Microtrombidium* Haller s. st.
   Dorsal body hairs generally of two types, often strongly modified, cup-shaped, bulbate, spine-like or otherwise .. .. 9.
   Subgenus *Enemothrombium* Berlese.
2. Eyes wanting .. .. 3.
   Eyes present, two on each side, sessile .. .. 4.
3. Front tarsi four times as long as high. Palpal tarsus clubbed. Dorsal body hairs relatively fewer and stouter and not so long (cf. fig.). Palpal tibia with 3 accessory claws. Legs IV much longer than body. *M. attolus* (Banks).

   Front tarsus four times as long as high. Dorsal body hairs more numerous (cf. fig.), longer, and more slender. Palpal tibia with 2 or 3 accessory claws. Legs IV only slightly longer than the body .. *M. barringunense* Hirst.
4. Front tarsus elongate, almost parallel-sided, slightly more than twice as long as high. Palpal tarsus not clubbed. Crista with posterior area.
   M. westraliense sp. nov.
   Front tarsus elliptical, not parallel-sided .. .. 5.
5. Body hairs short and broad, leaf-like, with lateral hairlets. Front tarsus twice as long as metatarsus, slightly more than half as long again as high. Accessory claw of palpal tibia as large as claw and followed by 4 or 5 spine-like setae .. .. *M. myrmicum* sp. nov.

   Body hairs not as above .. .. 6.
6. Hairs on dorsum short, stout, oval and pointed, with short hairlets. Front tarsus twice as long as high. Palpal tibia with one accessory claw followed by a more or less irregular group of strong setae. Palpal tarsus clubbed
   M. paranum Hirst.
   Dorsal body hairs not as above .. .. 7.
7. Dorsal body hairs rod- or spine-like, numerous, with only indistinct, close-lying hairlets. Front tarsus twice as long as high. *M. spinatum* sp. nov.

   Dorsal hairs not as above .. .. 8.
8. Front tarsus slightly more than 3 times as long as high and much longer than metatarsus. Hairs of dorsum as figured by Banks. Palpal tarsus not clubbed.
   M. aequalis (Banks).
   Front tarsus $2\frac{1}{2}$ times as long as high, metatarsus nearly as long. Palpal tibia with one accessory claw followed by a series of graduated spine-like setae. Body hairs slender and delicate .. .. *M. affine* Hirst.

Front tarsus less than twice as long as high, metatarsus as long as tarsus is high. Palpal tibia with accessory claw and a series of six stout setae. Palpal tarsus not clubbed .. .. *M. karriensis* sp. nov.

9. Larger dorsal hairs cup-shaped .. .. 10.

Larger dorsal hairs not cup-shaped .. .. 13.

10. Smaller dorsal hairs cup-shaped, with minute denticles .. .. 11.

Smaller dorsal hairs not cup-shaped .. .. 12.

11. Larger dorsal hairs with stem suddenly expanding to form the cup. Front tarsus 3½ times as long as high .. .. .. *M. (E.) simile* Hirst.

Larger dorsal hairs with stem gradually expanding from base to cup. Front tarsus less than 3 times as long as high .. *M. (E.) hirsti* sp. nov.

12. Smaller body hairs very irregular, usually with small lateral processes. Front tarsus more than 4 times as long as high .. *M. (E.) wyandrae* Hirst.

Smaller body hairs more regular, rod-like. Front tarsus more than 3 times as long as high .. .. *M. (E.) collinum* Hirst.

13. Longer dorsal hairs either branched distally, bushy, or ending in two scale-like or leaf-like halves. Front tarsus twice as long as high. *M. (E.) koordanum* Hirst.

Longer dorsal hairs otherwise .. .. 14.

14. Longer dorsal hairs very long and spine-like .. .. .. 15.

Not so .. .. 16.

15. Smaller dorsal hairs tapering to a point with comparatively short hairlets. Long hairs with only indistinct ciliations, 200 μ long. Front tarsus two and a half times as long as high and one-fourth as long again as metatarsus. *M. (E.) victoriense* sp. nov.

Small dorsal hairs not tapering, blunt at apex, and with relatively long hairlets. Longer dorsal hairs only 80–82 μ in length. Front tarsus twice as long as high and almost twice as long as metatarsus *M. (E.) southcotti* sp. nov.

16. Front tarsus elongate, parallel-sided, 4 times as long as high. Body hairs relatively short, the longer ones bi- or tri-furcate apically. *M. (E.) retentus* (Banks).

Front tarsus elliptical .. .. 17.

17. Longer dorsal hairs clavate with long hairlets. Front tarsus less than twice as long as high and twice as long as metatarsus .. *M. (E.) newmani* sp. nov.

Longer body hairs, not clavate although parallel-sided, with short hairlets. Front tarsus more than twice as long as high, and about half as long again as metatarsus .. .. *M. (E.) adelaidicum* sp. nov.

TROMBICULA Berlese, 1905.

TROMBICULA SIGNATA sp. nov.

Description: Length 1·2 mm. Colour in life probably red. Crista and sensillary area as in genus (cf. fig.). Eyes one on each side, large, and placed close

to but slightly posterior of the sensillary area. Front tarsus two and a half times as long as high and one-third as long again as metatarsus. Palpal tibia with the usual apical claw and two accessory claws as well as a number of strong setae. Palpal tarsus stout, hardly clubbed, and not quite reaching tip of claw. Body hairs of one type as figured and 40 μ in length.

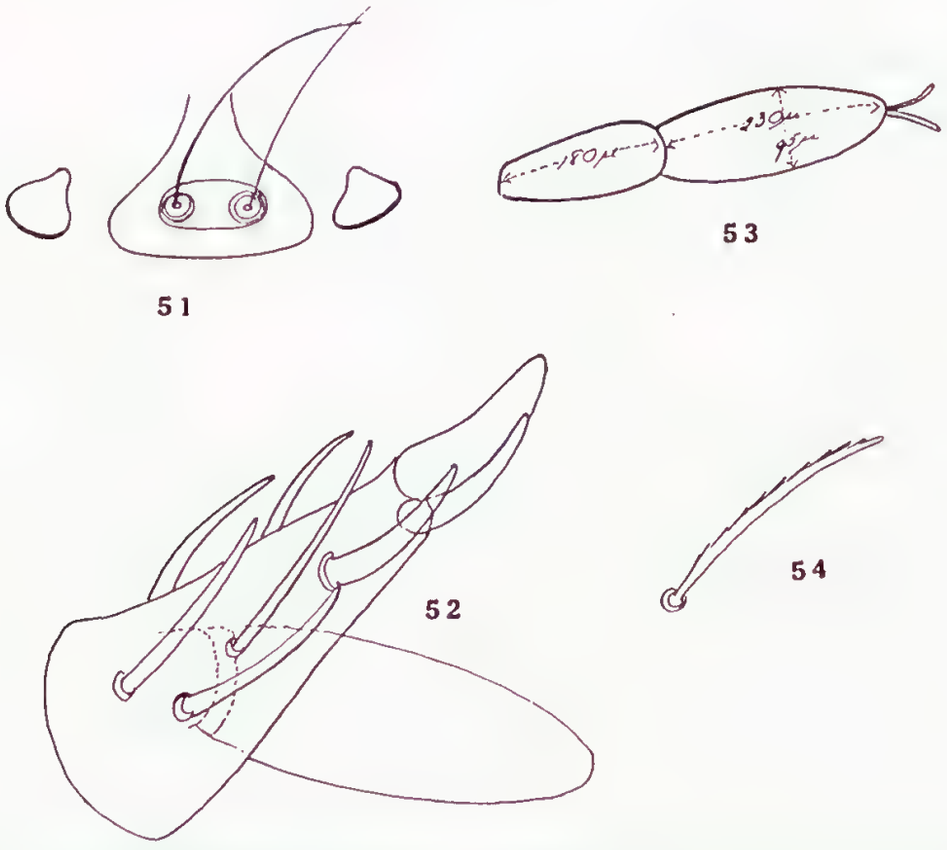

Fig. 51–54. *Trombicula signata* n.sp.: 51, sensory hairs and eyes; 52, palp; 53, front tarsus and metatarsus; 54, dorsal hair.

Type: A single specimen collected by myself in Western Australia in 1931, precise locality uncertain, but probably Perth district. The preparation is in the South Australian Museum.

CAENOTHROMBIUM Oudemans, 1928.

In this genus the crista is entire, with a medial sensillary area, a thick posterior stem, and a broad, somewhat Y-shaped anterior plate much wider than the sensillary area. The anterior margin of this frontal plate is straight or only slightly sinuate. In Oudemans' drawings the centre of this plate is shown as unchitinized, the arms of the Y being joined by an anterior transverse band or rod. In the Australian species which I refer to this genus the whole of the plate is more or less chitinized and the anterior margin a little more sinuate. The tarsi are without pulvilli or pseudopulvillar hairs. The eyes are two on each side and pedunculate as in *Allothrombium*.

To this genus I would refer all those species placed by Hirst in *Dinothrombium* Oudemans (= *Trombidium* Berlese, 1912, nec. Fabr., 1893). In all specimen's available of Hirst's types the crista has been dissected and examined. They have all been found to conform to that described by Oudemans for *Caenothrombium*. The name *Dinothrombium* is now used for *Trombidium* (Fabr., 1893 nec. 1775) Berlese, 1912, and *Sericothrombium* Berlese, 1910, has been replaced by *Trombidium* Fabr., 1775.

In his paper ([13]) Oudemans on page 81 compares his genus *Xenothrombium* to *Dinothrombium* as follows: "Die Crista ist nicht in drei Teile geteilt. *Dinothrombium* wird also beiseite geschoben". Yet, in his key to the genera of Trombidiidae in the same paper (page 90) he places *Dinothrombium* in the section "G1. Crista ungeteilt". This is obviously an error, for *Dinothrombium* (*Trombidium* Berlese) has three distinct parts to the crista, as is distinctly shown by Berlese's figure (Trombidiidae. Redia, 1912). In *Caenothrombium* the crista is entire, except in so far as the anterior plate can be considered a distinct part. In *Dinothrombium* the anterior portion is also plate-like, but of an entirely different shape. Furthermore, the tarsi in *Dinothrombium* are furnished with a small cluster of hairs at the tip, forming a kind of pseudopulvillus, as is described later for the genus *Austrothrombium* gen. nov.

CAËNOTHROMBIUM SERICATUM (Rainbow, 1906).

Syn. *Trombidium sericatum* Rainbow, 1906.

Dinothrombium splendidum Hirst, 1928.

Dinothrombium ventricosum Hirst, 1928.

Of this species I have been able to examine Rainbow's type material in the Australian Museum. This consists of 8 specimens of rather varying sizes, the largest being a gravid female of about 4·5 mm. in length, the others much smaller. The type of Hirst's *D. splendidum* is in the South Australian Museum, and consists of three microscopic slides of various parts. There is also a mount of the front leg of another example from Mullewa, West Australia, in the same collection; while a mount of the palp of this specimen was found amongst the Hirst material left in Adelaide. The type material of *D. ventricosum* Hirst, consisting of three slides of the palp, first leg and cephalic area, is in the Australian Museum.

A careful study of the above material reveals no essential differences between the three species, and they are therefore regarded as synonymous. In Rainbow's description there are distinct errors, the most important being his statement that

the eyes, two on each side, are sessile. Actually they are placed on distinct elongated peduncles, as in other members of the genus.

The following additional characters are taken from one of his specimens: front tarsus parallel-sided, 4·8 times as long as high, 670 μ by 140 μ, metatarsus 500 μ long. Eyes two on each side, pedunculate. Dorsal body hairs uniform, 90 μ long, with parallel sides, stout and blunt at tip. Palpi as in genus. Crista as figured.

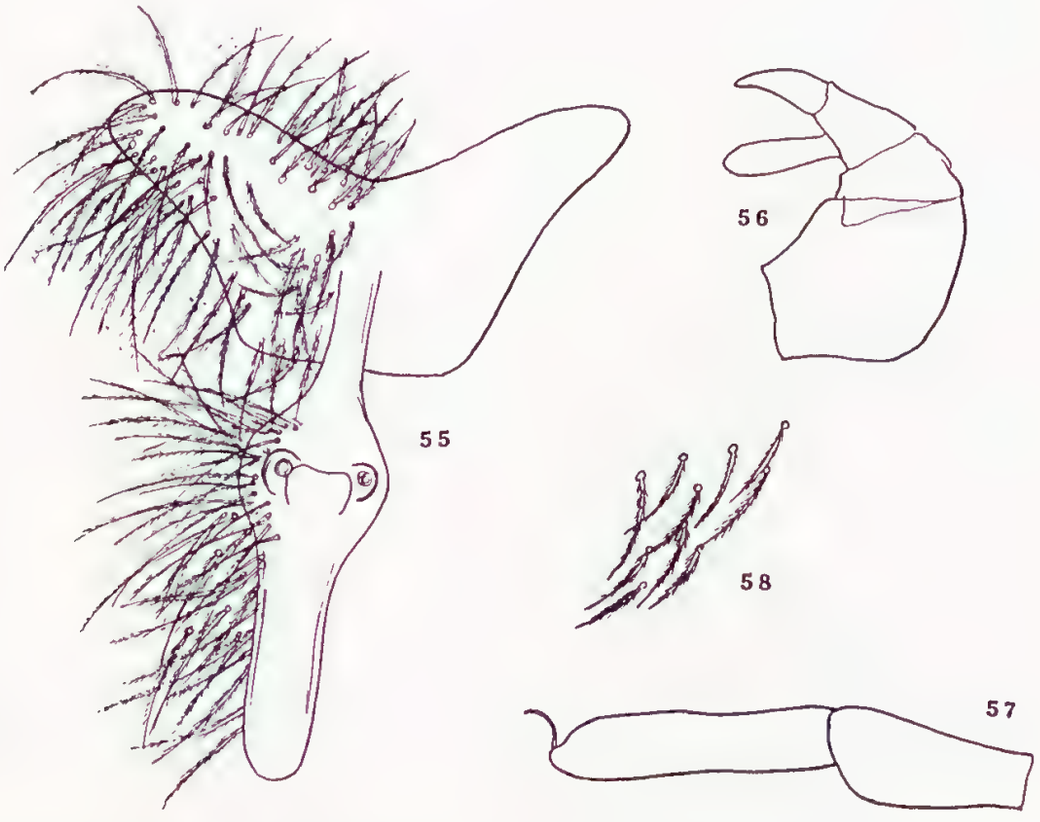

Fig. 55–58. *Caenothrombium sericatum* (Rainbow): 55, crista; 56, palp; 57, front tarsus and metatarsus; 58, posterior dorsal setae.

In the above details it will be noticed that the tarsus is somewhat longer in proportion to its height than given by Hirst for *D. splendidum*, but the use of this character must not be pressed too far. The body hairs are also rather longer than in *D. splendidum*, 60 μ, but are otherwise similar.

CAENOTHROMBIUM AUGUSTAE (Hirst, 1928).

Syn. *Dinothrombium augustae* Hirst, 1928.

This is one of the more easily distinguished species (cf. Key). The type is in the South Australian Museum.

CAENOTHROMBIUM TORRIDUM (Hirst, 1928).

Syn. *Dinothrombium torridum* Hirst, 1928.

Dinthrombium taylori Hirst, 1928.

The type of *D. torridum* is in the South Australian Museum, while among the Hirst material left in Professor Harvey Johnston's possession were two mounts of the cuticle and chelicerae of *D. taylori*. The remainder of the latter species I have not been able to obtain, but from a study of what is available there appears to be no essential differences between the two forms. Four other specimens from Adelaide, South Australia, in May, 1933, and two from Waroona, West Australia, in November, 1931, all collected by myself, can be referred to this species.

CAENOTHROMBIUM MONTIVAGUM (Hirst, 1928).

Syn. *Microtrombidium montivagum* Hirst, 1928.

Dinothrombium montivagum Hirst, 1929.

Dinothrombium rainbowi Hirst, 1928.

This species was originally placed in the genus *Microtrombidium* (9), but later Hirst removed it to *Dinothrombium* (10). The type specimen, minus one of its front legs, is in the Australian Museum. The missing leg was found as a mount amongst the material left by Hirst in Adelaide. The type of *D. rainbowi* is also in the Australian Museum. It is undoubtedly synonymous with *montivagum*, which has slight page priority.

A single specimen collected by myself at Mullewa, West Australia, in 1931, and another from Buckland Park, South Australia, in August, 1933, are to be referred to this species. These specimens are now in the South Australian Museum.

CAENOTHROMBIUM CRASSUM (Hirst, 1928).

Syn. *Dinothrombium crassum* Hirst, 1928.

The type is in the South Australian Museum collections, while a mount of a piece of the cuticle was amongst the Hirst material.

CAENOTHROMBIUM NOBILE (Hirst, 1928).

Syn. *Dinothrombium nobile* Hirst, 1928.

The type is in the South Australian Museum, and a piece of the cuticle was amongst the Hirst material.

CAENOTHROMBIUM ALBUM sp. nov.

Description: Size small, 1·65 mm. in length, 1·2 mm. wide at widest point. Anterior legs longer than body, 3·0 mm., posterior legs 2·25 mm. Colour bright red, with a large white patch on each side of the posterior portion of the broad part of the body, and another, less defined, at apex of body. Legs yellowish. Palpal tibia with strong but comparatively short claw, palpal tarsus elongate and

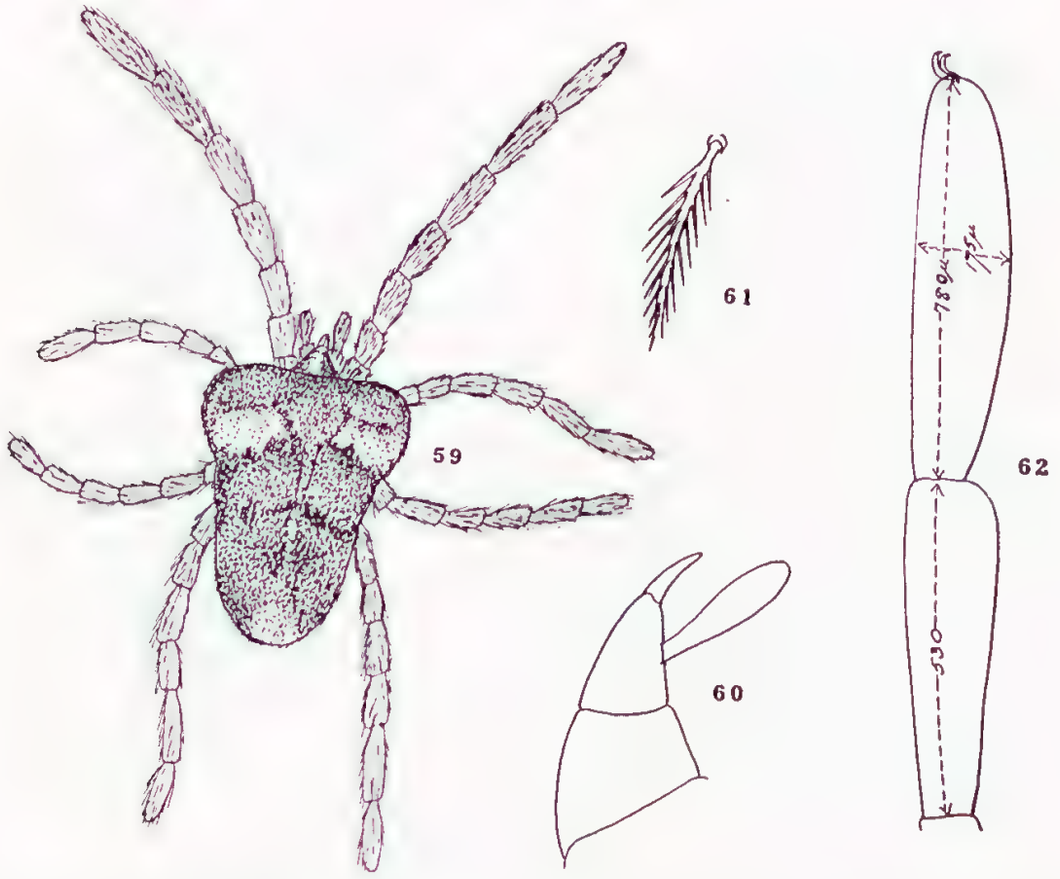

Fig. 59–62. *Caenothrombium album* n.sp.: 59, entire animal; 60, palp; 61, dorsal seta; 62, front tarsus and metatarsus.

clubbed and very much overreaching claw. Front tarsus elongate, four and a half times as long as high, metatarsus three-fourths the length of tarsus. Front tarsus 780 μ by 175 μ, metatarsus 530 μ long. Hairs of uniform type, slender and tapering, slightly curved, with long hairlets, 60 μ long. Eyes two on each side, pedunculate. Crista normal for this genus.

Syntypes: Adelaide, 1933, in the South Australian Museum. Other specimens from Denmark, West Australia, in July, 1932 (H.W.), and Riverton, South Australia, 1933 (H.W.).

CAENOTHROMBIUM NYNGANENSE (Hirst, 1928).

Syn. *Dinothrombium nynganense* Hirst, 1928.

The syntype material of this species was amongst the Hirst preparations left with Professor Harvey Johnston, and is now in the South Australian Museum.

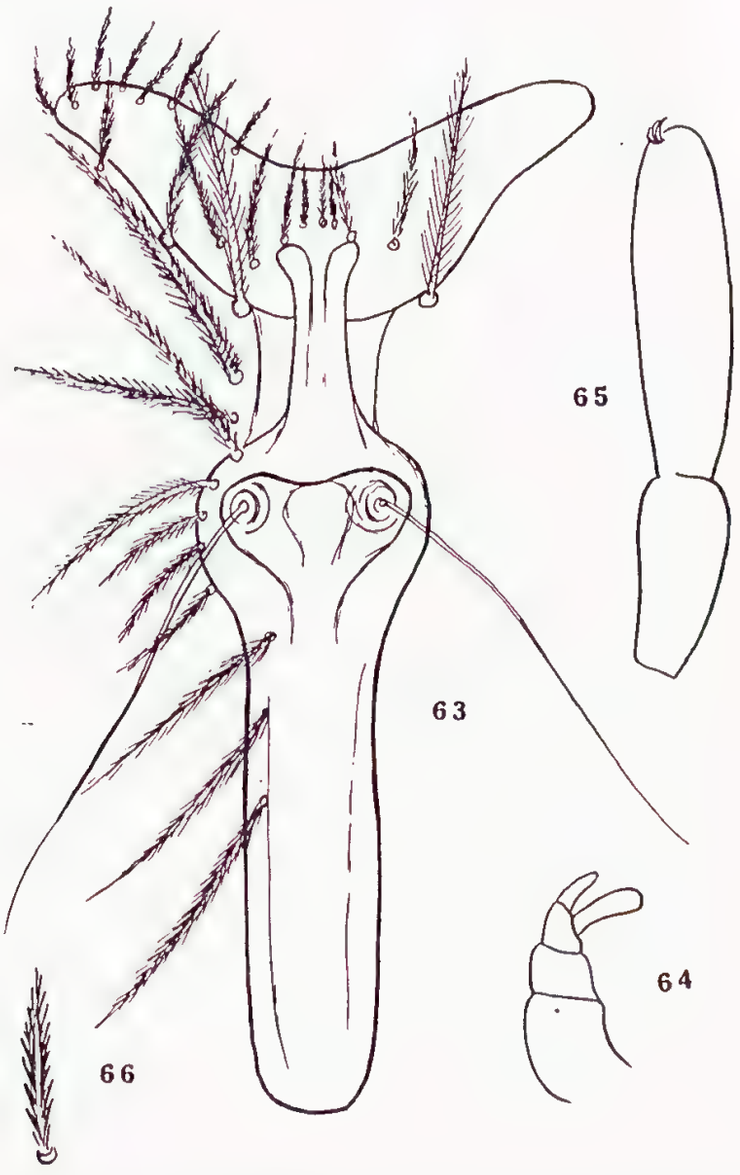

Fig. 63. *Caenothrombium nynganense* (Hirst): crista. Fig. 64–66. *Caenothrombium miniatum* n.sp.: 64, palp; 65, front tarsus and metatarsus; 66, dorsal seta.

In life this species has the white dorsal patches as in the preceding, but they are not so well defined.

It is apparently a fairly common and widely distributed species, and in the South Australian Museum are examples from the following localities:

Two, Adelaide, 1933 (H.W.); a nymph, Mullewa, West Australia, September, 1931 (H.W.); five, Dyne Swamp, Narracoorte, South Australia, September, 1933 (D.C.S.); one, Glen Osmond, South Australia, 1933 (H.W.). There is

also a specimen in the Australian Museum collection collected in the National Park, New South Wales, October, 1933 (A. Musgrave).

CAENOTHROMBIUM MINIATUM sp. nov.

Description: Length 1·5 mm. Colour in life red. Crista present and of the *Caenothrombium* type, 200 μ long. Eyes two on each side, pedunculate. Legs I and IV 1,575 μ long, II and III 1,225 μ long. Palpi normal, as figured, with slightly clubbed tarsus overreaching the tip of claw. Front tarsus long and rather parallel-sided, 470 μ long by 120 μ high, metatarsus 235 μ long. Clothing dorsally of uniform stout and blunt setae which are strongly ciliated; these setae are much stouter than in *C. nynganense* and not so numerous. Length of setae 35 μ.

Type: From moss, Belair, South Australia, May 18, 1933 (R.V.S.); in the South Australian Museum.

Remarks: This species is closely related to *C. torridum* (Hirst) and *C. nynganense* (Hirst). From the former it differs in size and in the dorsal body hairs, from the latter in size, in the dimensions of the front tarsi, and in the dorsal body hairs.

KEY TO THE AUSTRALIAN SPECIES OF CAENOTHROMBIUM.

1. Dorsal body hairs of two distinct sizes. Front tarsus 3 times as long as high, 425μ long .. *C. montivagum* (Hirst), syn. *D. rainbowi* Hirst.

   Dorsal body hairs uniform .. .. 2.

2. Front tarsus very elongate, about 7 times as long as high. Length of animal 2·4 mm. .. .. *C. augustae* (Hirst).

   Front tarsus much shorter, not exceeding about $4\frac{1}{2}$ times as long as high 3.

3. Front and hind legs much longer than body. Front tarsus $4\frac{1}{2}$ times as long as high, 780 μ by 175 μ. A large, well-defined white patch on each side of broadest portion of body and another at apex *C. album* sp. nov.

   Front and hind legs scarcely longer than body .. .. .. 4.

4. Smaller species not exceeding 4·0 mm. in length .. .. .. 5.

   Larger species more than 4·0 mm. in length .. .. .. 6.

5. Front tarsus 4–$4\frac{1}{2}$ times as long as high. Dorsal body hairs 60–90 μ long, slender, tapering, with long hairlets.
   C. torridum (Hirst), syn. *D. taylori* Hirst.

   Front tarsus almost 4 times as long as high. Dorsal body hairs stout, blunt, and strongly ciliated, 35 μ long. .. .. .. *C. miniatum* sp. nov.

   Front tarsus $2\frac{1}{2}$ times as long as high. Body hairs fairly stout and reaching 65 μ in length .. .. *C. nynganense* (Hirst).

6. Posterior dorsal hairs short and stout, parallel-sided, with short hairlets, often slightly swollen distally, 50–60 μ long, and slightly curved. Front tarsus $4\frac{1}{2}$ times as long as high.

C. sericatum (Rainbow), syn. *D. splendidum* Hirst, *D. ventricosum* Hirst.

Posterior dorsal hairs longer and straighter, 75 μ long, more tapering, and never swollen distally. Front tarsus 3 times as long as high. *C. crassum* Hirst.

Posterior body hairs longer still, 150 μ, slightly curved, more tapering and delicate. Front tarsus $3\frac{1}{2}$ times as long as high .. *C. nobile* (Hirst).

AUSTROTHROMBIUM gen. nov.

This new genus is characterized by the peculiar shape of the anterior plate of the crista. This plate is very much broader than the median sensillary area, and has its anterior margin very deeply excised and the lateral margins sloping strongly inwards and backwards, so that the plate appears to consist largely of two forwardly directed prongs. The crista is entire, with a moderately thickened posterior stem. The tarsi are without a true pulvillus, but have a number of hairs, some 5 or 6, which form a kind of pseudopulvillus. This is similar to that figured by Berlese (Redia, 1912, p. 6, fig. 1b) for *Dinothrombium* (*Trombidium*). In *Dinothrombium* the anterior plate is straight-sided and the anterior margin is only sinuate; the crista also is divided behind the sensillary area, so that if the anterior plate is regarded as a separate part it can be said to be divided into three parts.

In this genus I place Hirst's *Allothrombium (Mesothrombium) australiense*, *A. (M.) insigne*, and *A. (M.) kondinium*. One might have kept Hirst's name *Mesothrombium* for this genus but that the genotype of *Mesothrombium* is *A. (M.) antipodianum* Hirst, which is a true *Allothrombium*, and not congeneric with the other three species.

AUSTROTHROMBIUM AUSTRALIENSE (Hirst, 1929).

Syn. *Allothrombium (Mesothrombium) australiense* Hirst, 1929.

The two syntypes of this species are in the Australian Museum. In addition to the spirit material two preparations of the front leg and the palp exist, and I have made further mounts of the crista and a portion of the cuticle.

Hirst (10) states that this species is closely related to *Allothrombium antipodianum* Hirst, but a study of the generic characters will show that this is not the case.

AUSTROTHROMBIUM INSIGNE (Hirst, 1928).

Syn. *Allothrombium (Mesothrombium) insigne* Hirst, 1928.

The type is in the Australian Museum. This species is very closely related to the above, and although a study of the available material confirms all Hirst's minute differences it seems to me doubtfully more than a variety. The palpal tarsus is slightly longer in proportion to its height than in *A. australiense* and there are small differences in the structure of the dorsal hairs.

AUSTROTHROMBIUM KONDINIUM (Hirst, 1928).

Syn. *Allothrombium (Mesothrombium) antipodianum* v. *kondinium* Hirst, 1928.

Allothrombium (Mesothrombium) kondinium Hirst, 1929.

The type, which I have not been able to see, is in the Perth Museum, West Australia. Other examples, however, which I refer to this species have been

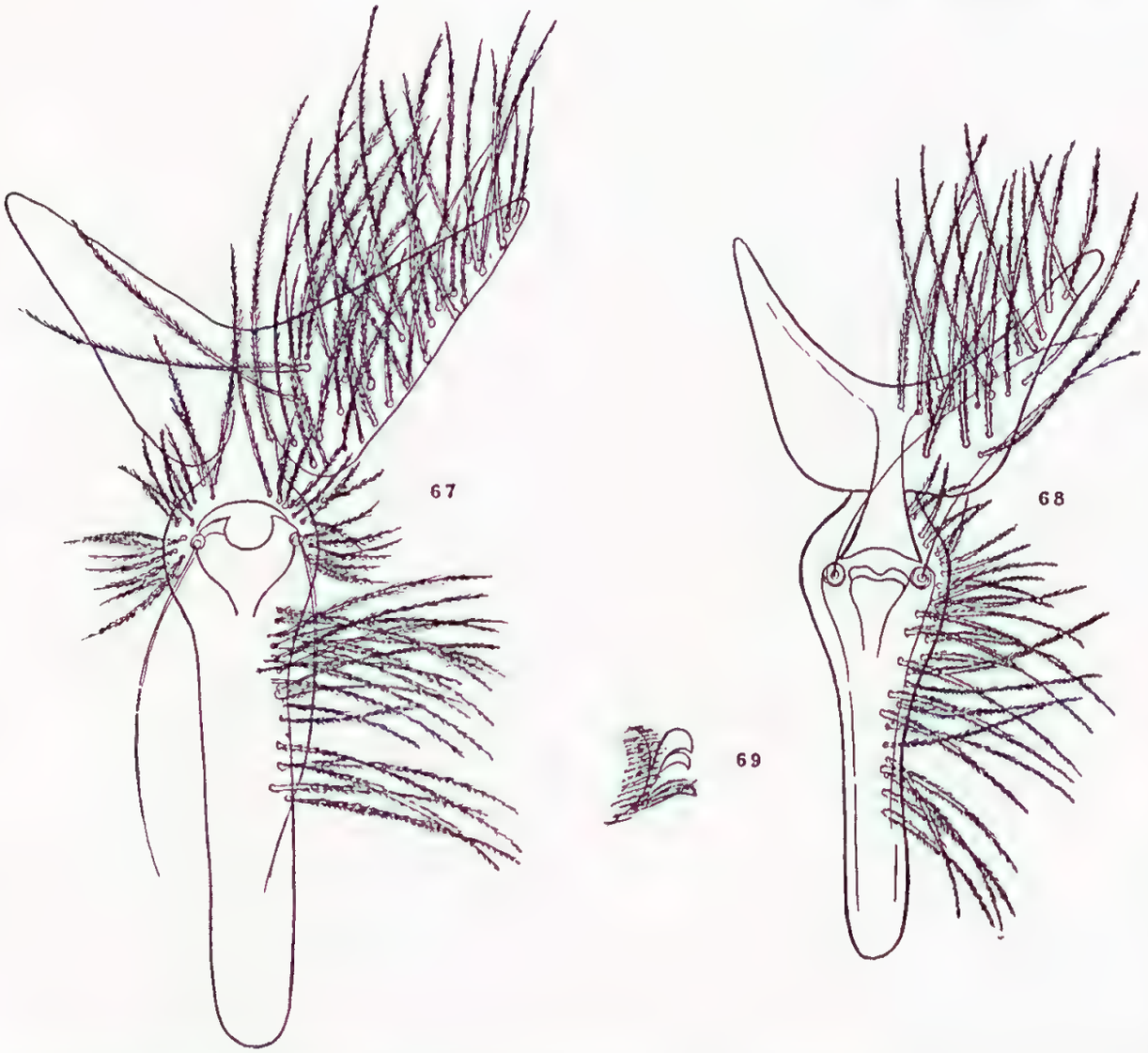

Fig. 67. *Austrothrombium australiense* (Hirst): crista. Fig. 68–69. *Austrothrombium kondinium* (Hirst): 68, crista; 69, tip of second tarsus.

collected by myself from the following localities: Armadale, West Australia, July, 1931; Mullewa, West Australia, September, 1931, and in the Porongorups, West Australia, in September, 1932.

The following details are taken from the Mullewa specimens: Large, 6–8 mm. Entirely red. Crista entire, with medial stigmal area and broad anteriorly pronged front plate (cf. fig.). Tarsus of front leg three times as long as high and a little longer than metatarsus. All tarsi with pseudopulvillar hairs. Palpal tibia with only the apical claw; palpal tarsus long, reaching tip of claw and slightly clubbed. Dorsal body hairs of two forms, a long type in which the hairlets are longer distally, giving the hair a clavate appearance, about 60 μ long, and a smaller type, which is stouter, pointed with a bare apex and smaller hairlets.

The above specimens are now in the South Australian Museum.

ALLOTHROMBIUM Berlese, 1903.

ALLOTHROMBIUM GUTTATUM Hirst, 1928.

Syn. *Allothrombium ornatum* Hirst, 1928.

In 1929 Hirst ([10]) gave a key separating these two species on slight differences in colour and structure of the longer body hairs. I have been able to examine his type material in the Australian Museum, which consists in the case of *A. guttatum* of three slides of the crista, first leg, and the palpi, with the remainder of the specimen in spirit. From the portion in spirit I have made a mount of a part of the cuticle. Of *A. ornatum* there are three slides of the first leg, palp, and the remainder of the specimen.

A careful examination of this material fails to show any good differences between the two species. At the best *A. ornatum* cannot be regarded as more than a slight variety of *A. guttatum*. The minor differences in the structure of the longer body hairs are of little value. In support of this view we find a specimen in spirit in the Australian Museum material, No. K. 58215, collected by Messrs. A. Musgrave and T. G. Campbell near Cutler's Pass, Williams River, New South Wales, 23/30/26, which was referred to by Hirst ([10], p. 172) as *A. ornatum*. The actual specimen, however is labelled as *A. guttatum*. I have mounted a portion of the cuticle of this specimen, and find that it agrees with *A. guttatum*.

ALLOTHROMBIUM ANTIPODIANUM Hirst, 1926.

Syn. *Allothrombium antipodianum* var. *olorinum* Hirst, 1926.

Allothrombium parvulum Hirst, 1929.

The type of *A. antipodianum* v. *olorinum*, and also a nymph labelled "*A. antipodianum* var. ?" by Hirst, are in the South Australian Museum. They are

both from the Swan River district of West Australia and marked as found "with ants". From the original descriptions I can find no valid differences between these and *A. parvulum* Hirst. Although I have not seen the type of the last species I have specimens from Pinjarra, West Australia, collected on October 1, 1931 (D.C.S.), which I had provisionally determined as *A. parvulum*, but which equally well agree with *A. antipodianum*.

It is possible that Hirst's *A. terraereginae* may also be synonymous but I have no material available.

ALLOTHROMBIUM WYANDRAE Hirst, 1928.

The first leg and palp of the type of this species were found amongst the preparations in Professor Johnston's possession. They are now in the collection of the South Australian Museum.

To this species I refer specimens collected by Dr. R. J. Tillyard on Mount Kosciusko, F.C.T., in December, 1929.

ALLOTHROMBIUM DELICATULUM sp. nov.

Description: Length 1·0 mm., elongate oval in shape. Colour reddish. Eyes two on each side, pedunculate. Crista of typical form (cf. fig.). Front tarsus a little more than twice as long as high and rather longer than metatarsus. Palpal tibia with apical claw, palpal tarsus slightly clubbed, hardly reaching tip of claw. Body hairs of one type resembling those figured by Berlese for *A. meridionale*.

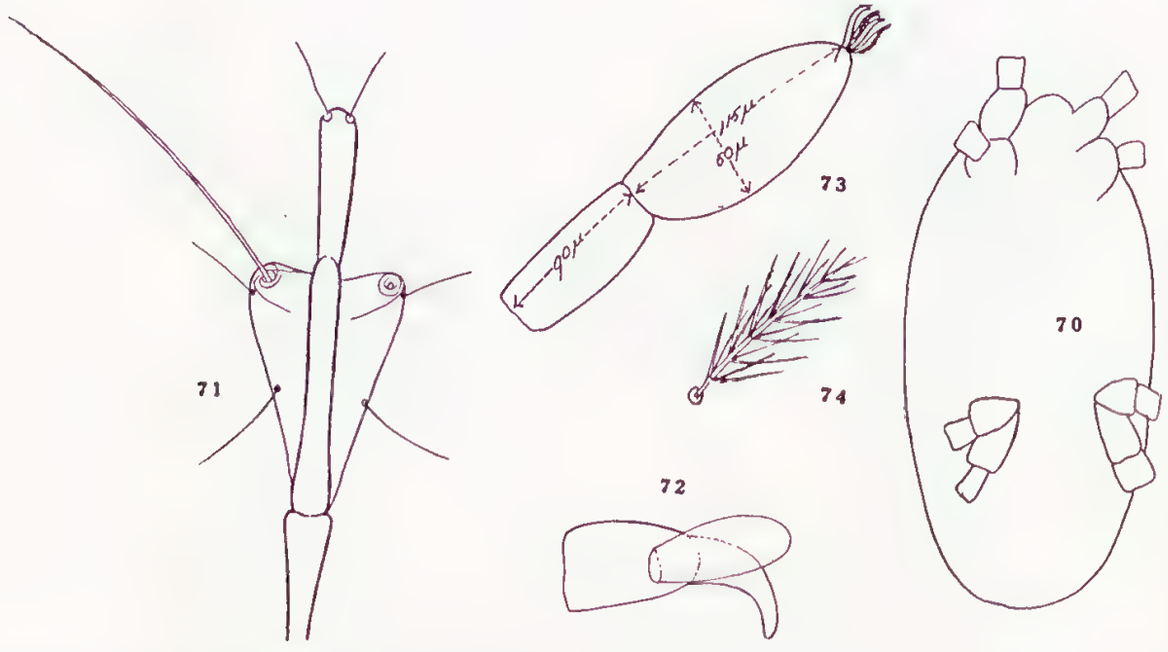

Fig. 70–74. *Allothrombium delicatulum* n.sp.: 70, outline of animal; 71, crista; 72, palp; 73, front tarsus and metatarsus; 74, dorsal seta.

Syntypes: Two specimens collected by Mr. D. C. Swan at Bridgewater, South Australia, June 6, 1932; in the South Australian Museum.

Remarks: Very close to *meridionale* Berlese, but differs in size and in the dimensions of the front tarsi.

KEY TO THE AUSTRALIAN SPECIES OF ALLOTHROMBIUM.

1. Very small species, 1·0 mm., sparsely haired. Hairs uniform and with few long secondary hairs .. ..*A. delicatulum* sp. nov.
   Much larger species .. .. 2.
2. Dorsum with a distinct pattern of red and white. Some of the body hairs very much elongated .. *A. guttatum* Hirst, syn. *A. ornatum* Hirst.
   Colour entirely red .. .. 3.
3. Body hairs of two distinct types .. .. 4.
   Body hairs uniform, short, plumose. Front tarsus twice as long as high. *A. wyandrae* Hirst.
4. Longer body hairs more clavate apically, axial thread thicker. Shorter hairs more tapering apically .. *A. antipodianum* Hirst, syn. *A. parvulum* Hirst.
   Longer body hairs less clavate, the hairlets longer near the base, stalk apparently shorter. Short hairs not tapering apically .. *A. terraereginae* Hirst.

KEY TO THE AUSTRALIAN GENERA OF ADULT TROMBIDIIDAE.

1. Body with lateral prominences .. .. *Chyzeria* Canestrini, 1897.
   Body without these .. .. 2.
2. Without a crista .. .. .. *Trombella* Berlese, 1887.
   With a crista; sensillary hairs not clavate .. .. 3.
3. Crista with two sensillary areas and four sensory hairs .. .. 4.
   Crista with only one sensillary area and two sensory hairs .. .. 5.
4. The sensillary areas separated, one at each end of crista. One eye on each side and placed in front of anterior end of crista. *Myrmicotrombium* gen. nov.
   The sensillary areas adjacent, behind one another. Two eyes on each side (1). *Diplothrombium* Berlese, 1910.
5. Eyes one or none on each side .. .. *Trombicula* Berlese, 1905.
   Eyes two or none on each side .. .. 6.
6. Eyes two on each side, pedunculate .. .. 9.
   Eyes, if present, then sessile and two on each side .. .. .. 7.
7. With a distinct nasus .. .. .. *Neotrombium* Leonardi, 1901.
   Without a nasus. Legs I and IV shorter than the body .. .. 8.

(1) In the genus *Rohaultia* Oudemans 1911, the posterior sensillary area is separated from the anterior, but placed in the middle of the crista and on a broad transverse plate. There are two eyes on each side.

8. Hairs feather-like and unmodified .. *Microtrombidium* s.str. Haller.
   Hairs of varying form with minute ciliations.
   Microtrombidium, subgen. *Enemothrombium* Berlese, 1910.
9. Tarsi with distinct pulvilli or a group of pulvilla-like hairs .. .. 10.
   Tarsi without these. Crista with broader anterior plate with straight or sinuate anterior margin. Crista entire with median sensillary area.
   Caenothrombium Oudemans, 1928.
10. Tarsi with distinct and true pulvilli. Crista in three parts, the median sensillary area broader and more characteristic *Allothrombium* Berlese, 1903.
    Tarsi with 5–6 pulvilla-like hairs. Crista entire with medium sensillary area and much broader anterior plate with forwardly directed arms or prongs.
    Austrothrombium gen. nov.

LARVAL FORMS OF TROMBIDIIDAE.

TROMBICULA Berlese.

TROMBICULA HIRSTI Sambon, 1927.

Of this species, the "ti-tree itch mite" of Queensland and South Australia, there were two slides each of two specimens in the Hirst material left in Adelaide. The specimens were collected at Robe, South Australia, by Mr. Stanley Hirst in

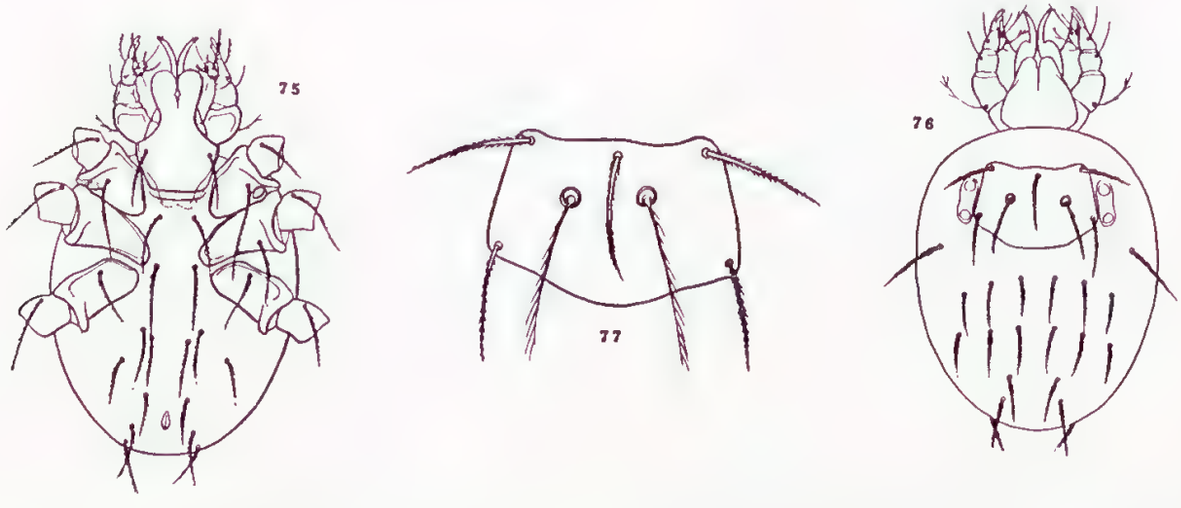

Fig. 75–77. *Trombicula hirsti* Sambon: 75, ventral view; 76, dorsal view; 77, dorsal shield (all after Sambon).

1928. One slide is now in the South Australian Museum. Another slide containing a number of specimens has also been presented to the Museum by Mr. D. C. Swan. These were collected in the same locality in 1934. To facilitate determination of these mites Sambon's figures are reproduced.

TROMBICULA NOVAE-HOLLANDIAE Hirst, 1929.

There were many slides of this species amongst the Hirst material, all taken from the ears of *Rattus greyi* from D'Estree Bay, Kangaroo Island, South Australia. These should probably all be regarded as syntypes. Some of them have been presented to the South Australian Museum by Professor Harvey Johnston.

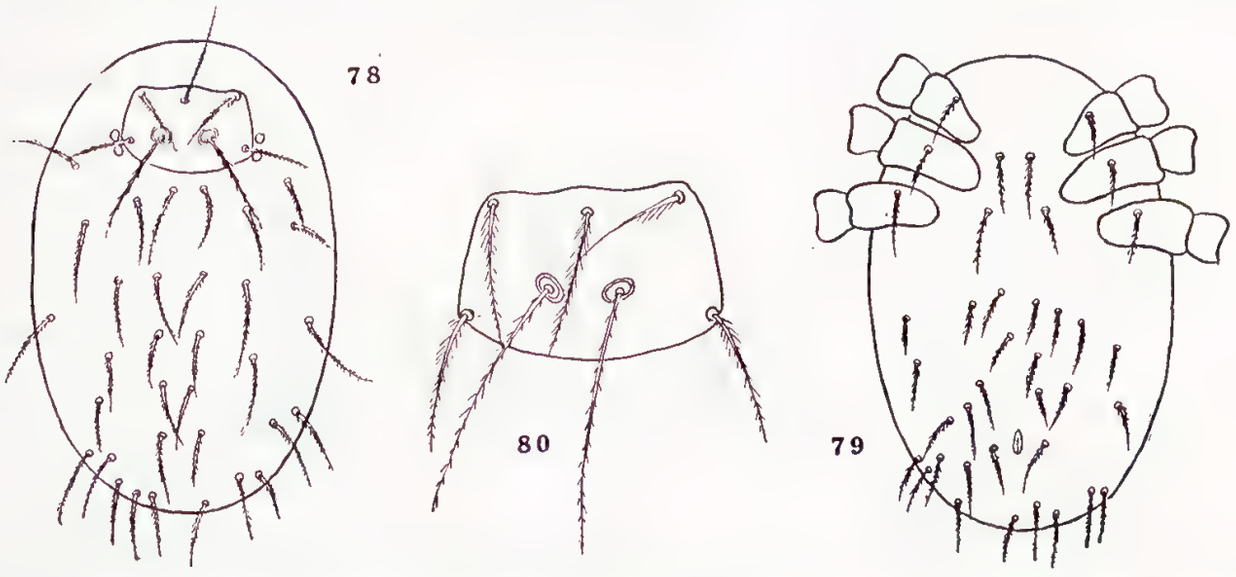

Fig. 78–80. *Trombicula novae-hollandiae* Hirst: 78, dorsal view; 79, ventral view; 80, dorsal shield (all after Hirst).

Other specimens in the South Australian Museum were obtained from the ears of *Potarus tridactylus*, collected at Bothwell, Tasmania, by Mr. H. H. Finlayson in August, 1931. Hirst's figures are reproduced.

SCHONGASTIA Oudemans, 1910.

SCHONGASTIA ANTIPODIANUM Hirst, 1929.

This species was obtained by Hirst from the ears of *Rattus greyi* from D'Estree Bay, Kangaroo Island, South Australia. Many of his syntypes were

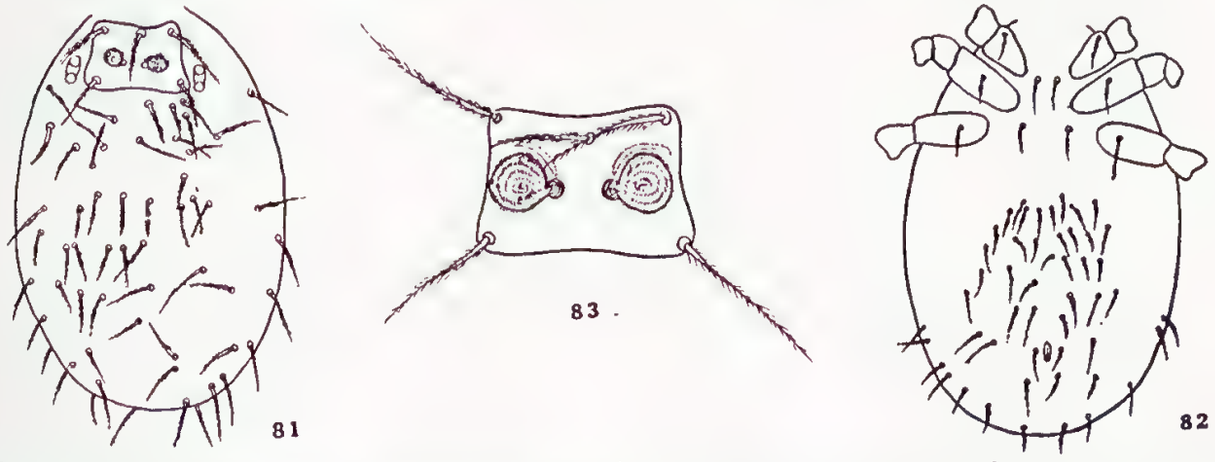

Fig. 81–83. *Schongastia antipodianum* Hirst: 81, dorsal view; 82, ventral view; 83, dorsal shield (after Hirst).

amongst the material left in Adelaide, and some have been presented to the South Australian Museum. For comparison Hirst's figures are reproduced.

SCHONGASTIA COORONGENSE Hirst, 1929.

Hirst described this species from specimens taken from the ears of a rodent at Robe, South Australia, in December, 1926. His syntypes were amongst the material left in Adelaide, and some have been presented to the South Australian Museum.

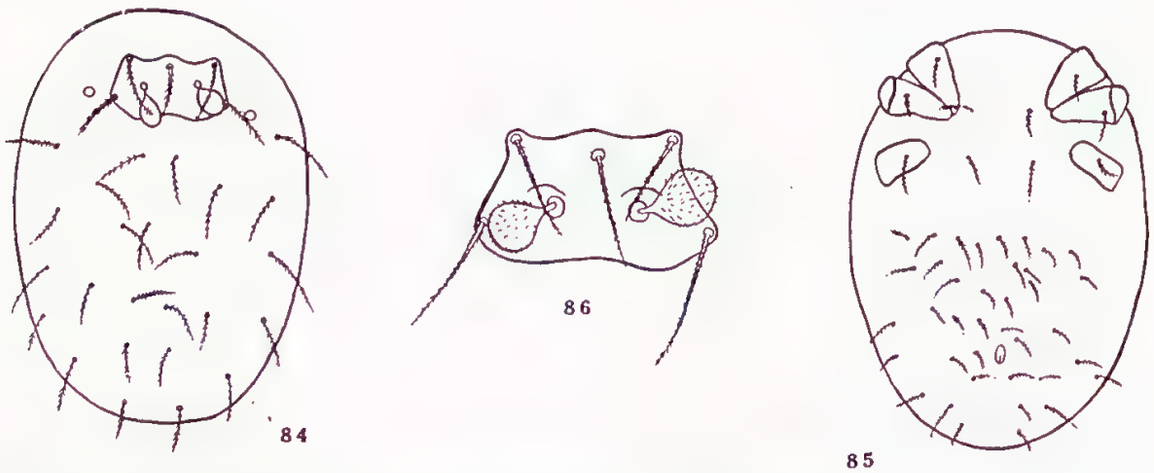

Fig. 84–86. *Schongastia coorongense* Hirst: 84, dorsal view; 85, ventral view; 86, dorsal shield (after Hirst).

SCHONGASTIA DASYCERCI Hirst, 1929.

From the ears of *Dasycercus cristicauda*, from Ooldea, South Australia. The syntypes were amongst the material left in Adelaide, and some of the slides are now in the collection of the South Australian Museum.

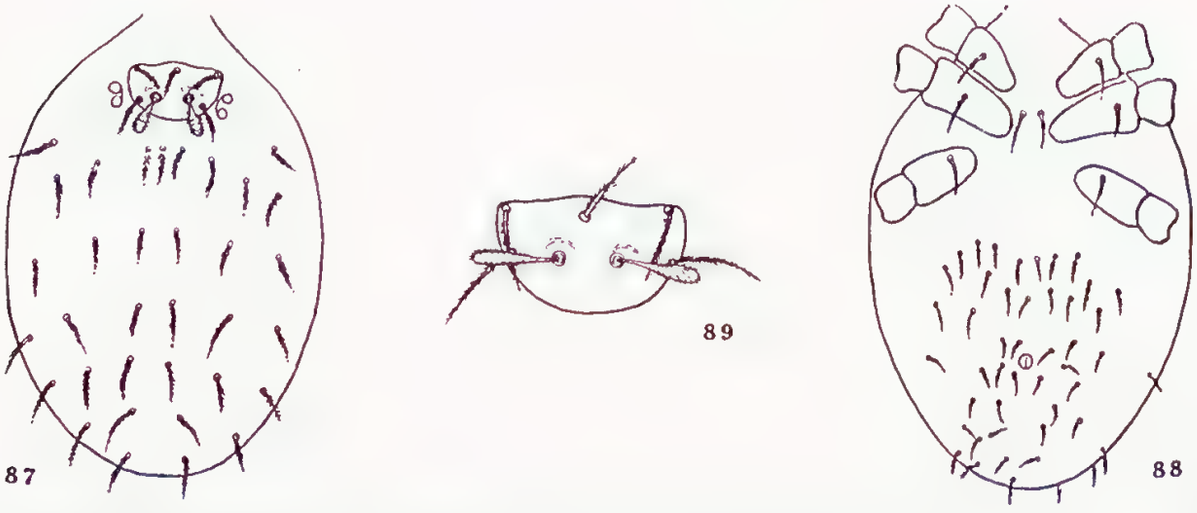

Fig. 87–89. *Schongastia dasycerci* Hirst: 87, dorsal view; 88, ventral view; 89, dorsal shield (after Hirst).

SCHONGASTIA WESTRALIENSE sp. nov.

Description: Sensory hairs of dorsal scutum elongate, clavate, with numerous fine ciliae, resembling those of *S. dasycerci* Hirst. Anterior lateral hairs of scutum shorter than the median anterior hair. Posterior lateral hairs of scutum very long, about three-fourths the width of scutum. Posterior margin of scutum sinuate and medially emarginate; anterior edge lightly concave. Eyes paired but indistinct. Dorsal body setae about 50, short, slightly curved and feathered,

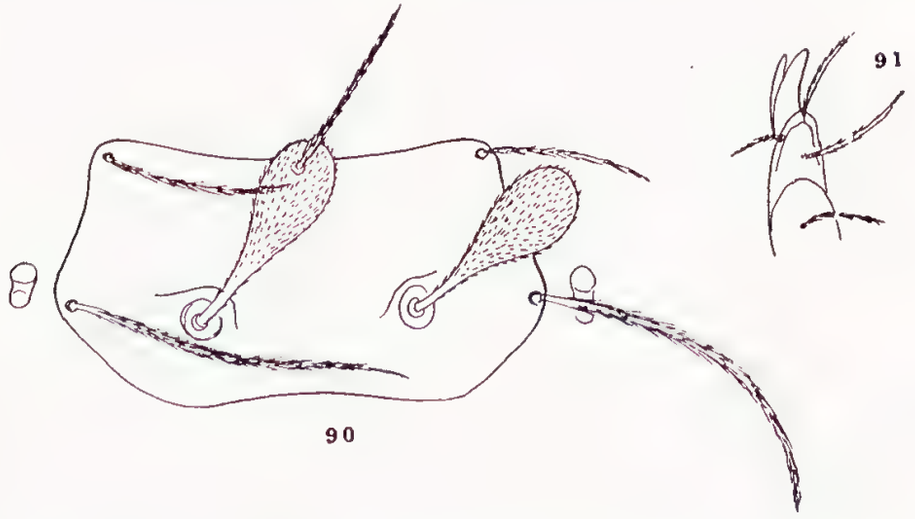

Fig. 90–91. *Schongastia westraliense* n.sp.: 90, dorsal shield and eyes; 91, tip of palp.

about 8 μ long. Hairs of palpi as in *Trombicula*, but those of the palpal tarsus are long and overreach the claw. Palpal claw with two accessory claws. Hairs of legs long and strongly ciliated, but there is no unfeathered hair as is described for *S. dasycerci* Hirst. Length of body 525 μ; first leg (excluding coxae) 210 μ, second 210 μ; third 250 μ; dorsal scutum in middle 55 μ long, width 105 μ; sensory hairs of scutum 38μ, anterior medial hair 50 μ, posterior lateral hair 76 μ.

Locality: Ears of a cat from Greenbushes, West Australia, August, 1931.

Syntypes: In the South Australian Museum.

SCHONGASTIA PETROGALE sp. nov.

Description: Dorsal scutum trapezoidal, the anterior margin straight and shorter than the posterior margin, which is slightly sinuate medially. Sensory hairs globular with very fine ciliae. Other hairs of scutum comparatively short and strongly feathered, little longer than the sensory hairs; the posterior lateral hairs are a little behind the sensory hairs. Eyes paired and equal. Dorsal body hairs very numerous, pointed, slightly curved, and with long secondary hairs (cf.

fig.). Palpi as figured, the longest feathered hair of tarsus overreaching tip of claw, which claw is trifurcate. Legs without any unfeathered hairs.

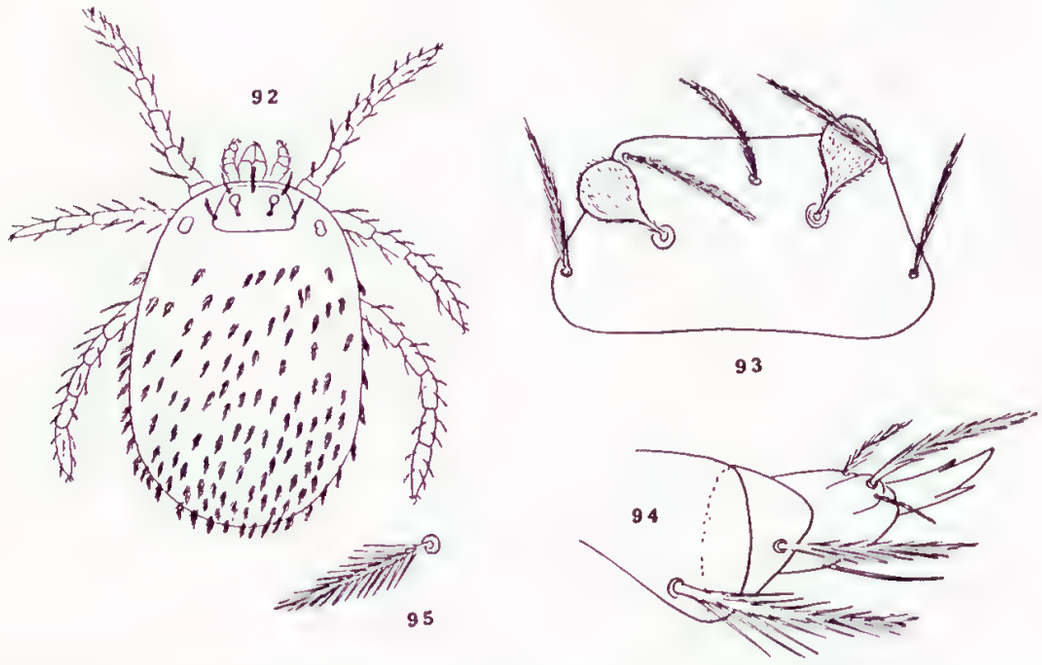

Fig. 92–95. *Schongastia petrogale* n.sp.: 92, dorsal view of animal; 93, dorsal shield; 94, palp; 95, dorsal hair.

Length 420 μ, breadth 270 μ, slightly constricted just behind the legs; front legs (excluding coxae) 220 μ, middle legs 180 μ, hind legs 230 μ. Length of scutum 38μ, width posteriorly 92 μ, anteriorly 74μ; length of sensory hairs of scutum 20 μ, of posterior hairs 37 μ, dorsal body hairs 35 μ.

Locality: Musgrave Ranges, South Australia, July, 1933, on scrotum of a wallaby, collected by Dr. C. J. Hackett.

Syntypes: In the South Australian Museum.

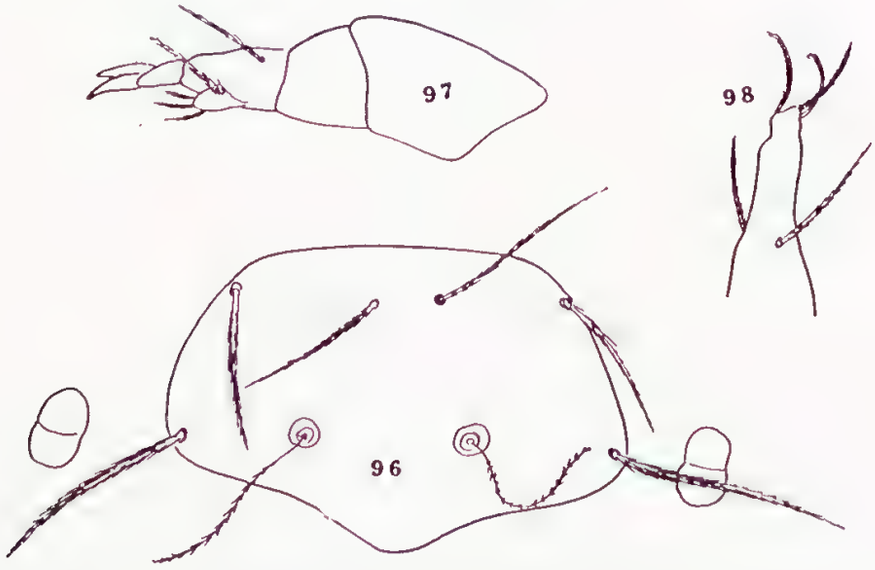

Fig. 96–98. *Leuwenhoekia australiense* Hirst: 96, dorsal shield and eyes; 97, palp; 98, tip of tarsus.

Remarks: This species differs from all hitherto described forms in the shape of the dorsal scutum and in the number and structure of the dorsal body setae.

LEUWENHOEKIA Oudemans, 1911.

LEUWENHOEKIA AUSTRALIENSE Hirst, 1929.

I have not been able to locate the types of this species, but in the South Australian Museum are specimens from the ears of a cat, collected at Glen Osmond, South Australia, by Mr. D. C. Swan in November, 1931.

KEY TO THE LARVAL TROMBIDIIDAE KNOWN FROM AUSTRALIA.

1. With only one antero-medial hair on scutum .. .. .. 2.
   With two antero-medial hairs on scutum .. Gen. *Leuwenhoekia* Ouds. *australiense* Hirst.
2. Sensory hairs of scutum long and fine with secondary hairlets .. .. 3. Gen. *Trombicula* Berl.
   Sensory hairs of scutum clavate or globose .. .. 4. Gen. *Schongastia* Ouds.
3. Dorsal scutum about one-third wider than long. The sensory and posterior hairs approximately in the middle line of scutum. Dorsal body setae 2-6-6-4-2. Posterior angles of scutum truncate. Smaller species. *T. hirsti* Sambon.
   Dorsal scutum at least twice as wide as long. The sensory and posterior hairs of scutum in a line well behind the middle. Dorsal body setae 2-6-6-6-6-6-4. Posterior angles of scutum rounded. Larger species. *T. novae-hollandiae* Hirst.
4. Sensory hairs of scutum clavate not globose .. .. .. 5.
   Sensory hairs of scutum globose not clavate .. .. .. 6.
5. Front margin of scutum produced slightly medially; lateral and posterior margins evenly rounded .. .. *S. dasycerci* Hirst.
   Front margin of scutum slightly concave, lateral margins divergent posteriorly, posterior margin slightly sinuate medially. *S. westraliense* sp. nov.
6. Body hairs very numerous, comparatively short, and with long secondary hairs. Ordinary hairs of scutum comparatively short. Posterior edge of scutum longer than anterior and straight or slightly sinuate. *S. petrogale* sp. nov.
   Body hairs not so numerous, longer, and with only short secondary hairs 7.
7. Dorsal scutum widest behind the middle. Posterior edge of scutum slightly sinuate medially. Sensory and posterior scutal hairs on line of greatest width. Lateral edges of scutum produced outwardly on line of greatest width .. .. *S. coorongense* Hirst.
   Dorsal scutum widest on posterior edge, posterior hairs at postero-lateral corners and well behind the sensory hairs which are submedial. Lateral edges of scutum straight.. .. .. *S. antipodianum* Hirst.

FAMILY ERYTHRAEIDAE.

ERYTHRAEUS Latreille, 1806.

ERYTHRAEUS CELERIPES (Rainbow, 1906).

Syn. *Rhyncholophus celeripes* Rainbow, 1906.

Leptus imperator Hirst, 1928.

This species was described and the entire animal figured by Rainbow in 1906 ([14]). The type material consisting of about a dozen specimens is in the Australian Museum. *Leptus imperator* was described by Hirst in 1928 without any figures. His type is in the collection of the South Australian Museum. I

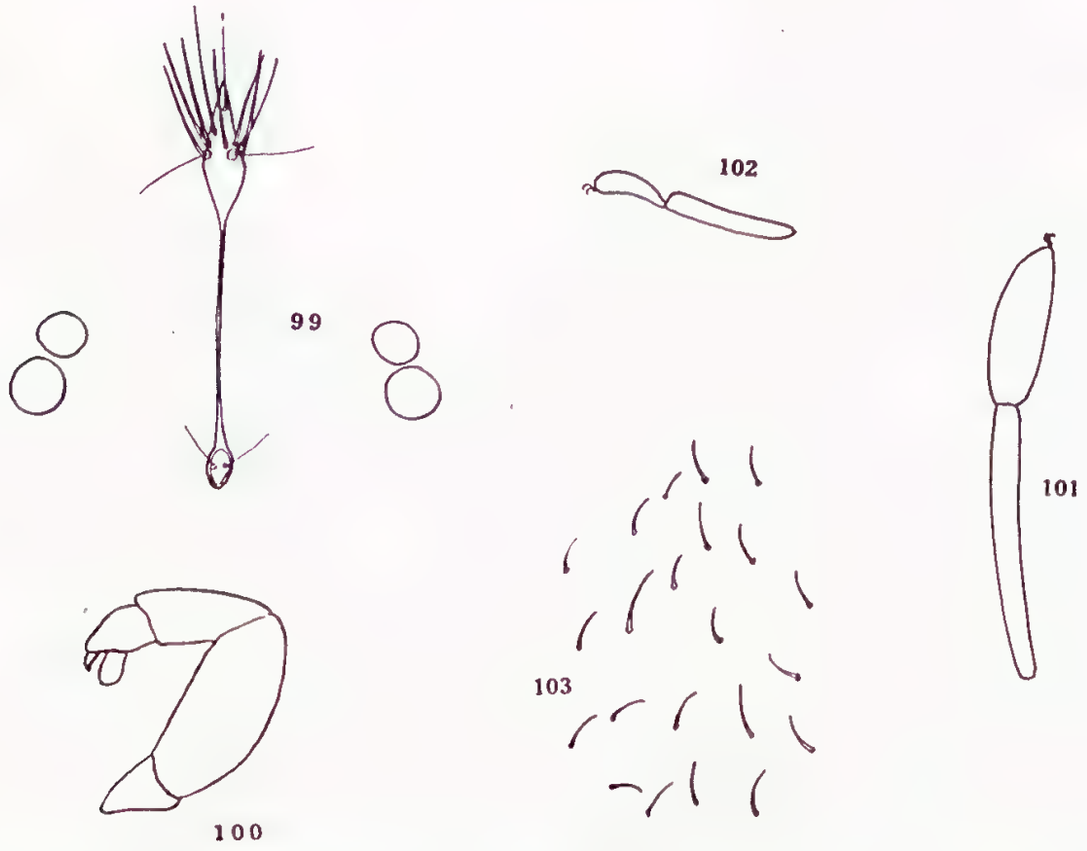

Fig. 99–103. *Erythraeus celeripes* (Rainbow): 99, crista and eyes; 100, palp; 101, front tarsus and metatarsus; 102, second tarsus and metatarsus; 103, dorsal setae.

have been able to compare this material, and without any doubt the two species must be regarded as synonymous. Both descriptions, however, are not satisfactory, and I have therefore drawn up the following fresh description from mounted specimens of Rainbow's material. The figures are also from the same specimens.

Redescription: Length to 3·8 mm. Crista distinct, linear, 1,480 μ long to tip of nasus, with two pairs of sensory hairs on enlarged areas at the extremities.

The anterior area of crista is produced into a conical nasus furnished with a number of long setae. The shield of the crista is indistinct. Eyes four, two on each side, sessile, slightly behind the middle of the crista, the anterior eye of each pair is slightly the smaller. Legs I and IV very much longer than the body, I 6·7 mm. long, II 3·8 mm., III 4·2 mm., IV 5·9 mm.; front tarsus 850 μ long by 270 μ high, metatarsus 1,500 μ, second tarsus 410 μ by 110 μ, tarsal scopulae fairly distinct except on front tarsi. Palpi as figured, with apical claw and short tarsus which is scarcely longer than wide. Dorsal body hairs short, curved, spiniform, 40 μ long, not ciliated; ventral hairs longer, reaching 120 μ. Long setae on nasus indistinctly ciliated.

Localities: In addition to the localities given by Rainbow and Hirst the writer has found this species under Eucalyptus bark at Armadale, West Australia, August 6, 1932, while Professor W. M. Wheeler has collected specimens in King's Park, Perth, West Australia, in September, 1931. In the Australian Museum are two specimens collected by Mr. A. Musgrave in the National Park, New South Wales, on October 2, 1933.

Remarks: In life this species is often of a dark shining metallic-green colour with a light dorsal stripe.

ERYTHRAEUS REGINAE (Hirst, 1928).

Syn. *Leptus reginae* Hirst, 1928.

Leptus antipodianus Hirst, 1928.

The syntypes of *L. reginae* and the type of *L. antipodianus* were amongst the Hirst material in Adelaide, and are now in the South Australian Museum. A critical study of this material fails to show any significant differences between the two species. They were both described in the same paper in which *L. reginae* has page priority.

The syntypes of *L. reginae* are from the Parklands, Adelaide, on December 2, 1927, but amongst Hirst's material were also specimens from Barringun, New South Wales, in June, 1927; Bourke, New South Wales, in August, 1927; and from Orange, Queensland, for which no date is given. The type of *L. antipodianus* is from Tanunda, South Australia, on March 24, 1927. In addition the writer has four specimens collected by himself on Rottnest Island, West Australia, in January, 1931.

As both descriptions are inadequate and without figures, a redescription and figures drawn from the syntypes of *L. reginae* are given.

Redescription: Length to 2·9 mm. Crista long and linear, with two enlarged

areas each bearing a pair of sensory hairs, one area at each end of crista. Crista without a distinct sheath. The anterior area of crista is produced into an elongate nasus furnished with a number of long strongly ciliated setae; length of crista to

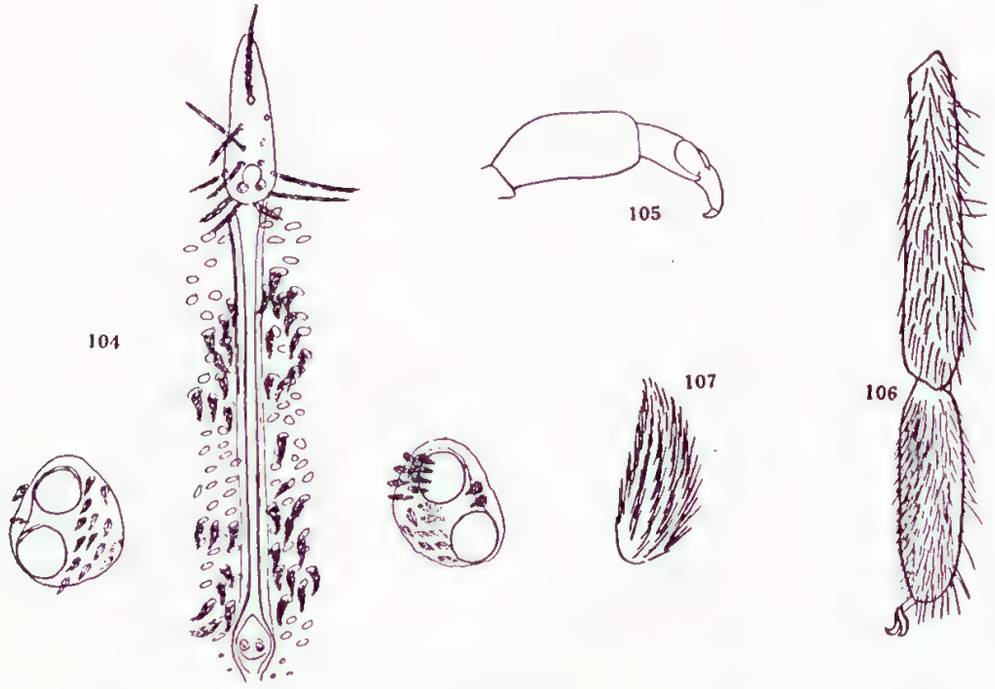

Fig. 104–107. *Erythraeus reginae* (Hirst): 104, crista and eyes; 105, palp; 106, front tarsus and metatarsus; 107, dorsal seta.

tip of nasus 1,200 μ. Eyes two on each side, sessile, on a distinct plate. Palpi normal, as figured. Legs I and IV longer than the body, I 4·3 mm. long, II 2·9 mm., III 3·3 mm., IV 5·4 mm.; front tarsus 540 μ long by 165 μ high, metatarsus 830 μ, tarsal scopulae fairly well developed. Dorsal hairs scale- or leaf-like, pointed, and broad with minute ciliations, 30–35 μ long.

ERYTHRAEUS PILOSUS (Hirst, 1928).

Syn. *Leptus pilosus* Hirst, 1928.

The type, from Dubbo, New South Wales, collected by Hirst on August 7, 1927, was found amongst the material left in Adelaide. It has now been presented to the South Australian Museum by Professor Harvey Johnston. A further specimen was found by myself under gum-tree bark in the grounds of the Waite Institute, Adelaide, South Australia, in September, 1933, and in the South Australian Museum are also three specimens collected at Belair, South Australia, in January, 1934 (R.V.S.).

As in the preceding species it is necessary to redescribe this form, and figures drawn from the type are given.

Redescription: Length 2·2 mm. Crista linear, 650 μ long, with enlarged stigmal areas at each end. The anterior area is bulbous and not produced into a nasus; it is furnished with a number of long pointed strongly ciliated setae. Eyes two on each side, sessile, on a distinct shield and placed fairly close to the

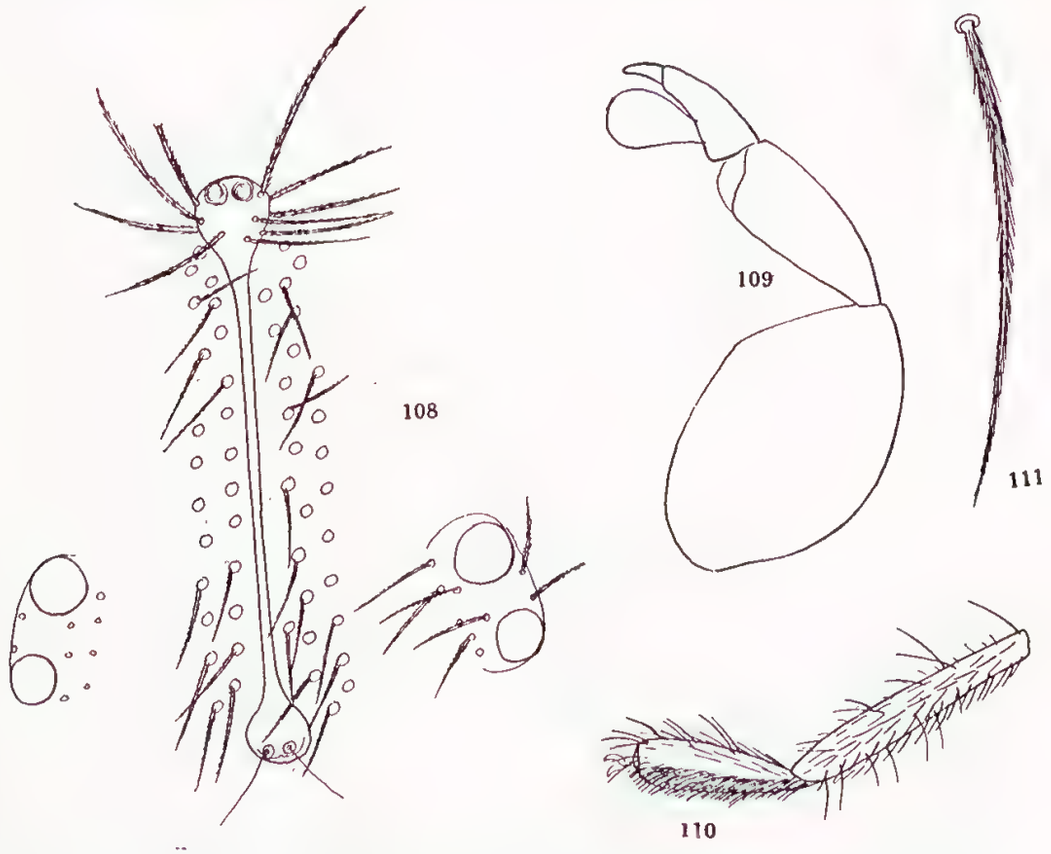

Fig. 108–111. *Erythraeus pilosus* (Hirst): 108, crista and eyes; 109, palp; 110, front tarsus and metatarsus; 111, dorsal seta.

crista but behind its middle. Palpi normal as figured. Legs I and IV longer than the body, I 3·35 mm. long, II 2·5 mm., III 2·5 mm., IV 4·2 mm., front tarsus 450 μ long by 120 μ high, metatarsus 665 μ. Clothing of long, pointed, strongly ciliated setae 200 μ long.

ERYTHRAEUS URRBRAE sp. nov.

Description: Length 2·6 mm. Colour dark, slightly reddish. Crista well chitinized, 750 μ long, with anterior and posterior sensory areas, the anterior of which is bulbous and not produced into a nasus, furnished with a number of long, finely ciliated, blunt setae. Eyes two on each side, slightly behind the middle of crista, sessile, ocular shield not distinct. Palpi normal, as figured, with fairly strong claw and long, clubbed tarsus reaching to or slightly beyond tip of claw. Legs I and IV longer than body, I 3·75 mm., II 2·4 mm., III 3·0 mm., IV 4·5 mm., front tarsus 550 μ long by 150 μ high, metatarsus 825 μ. Clothing

of numerous dark, strong setae, which are strongly ciliated and blunt apically, variable in length up to 200 μ, more numerous than in preceding species.

Syntypes: Two specimens in the South Australian Museum, collected by myself under Eucalyptus bark in the grounds of the Waite Institute, Urrbrae, South Australia, in September, 1933.

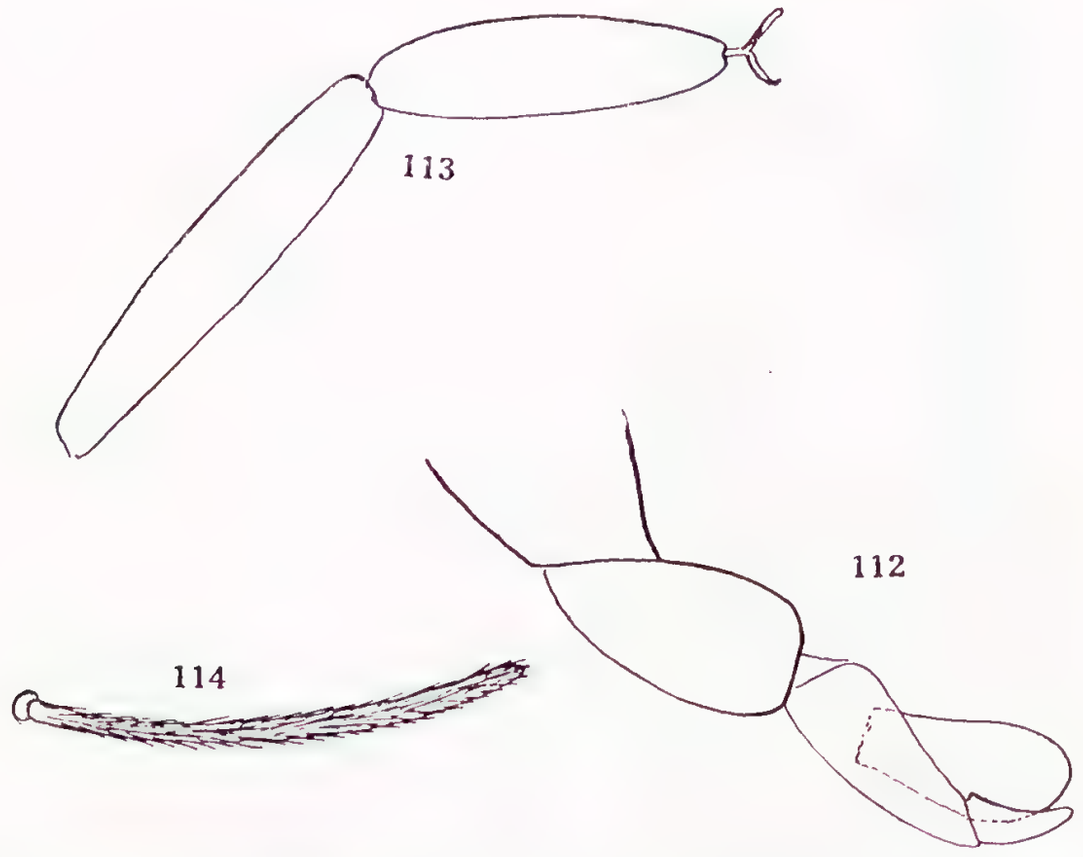

Fig. 112–114. *Erythraeus urrbrae* n.sp.: 112, palp; 113, front tarsus and metatarsus; 114, dorsal seta.

Remarks: Closely related to the preceding but distinct in the nature of the clothing.

KEY TO THE AUSTRALIAN SPECIES OF ERYTHRAEUS.

1. Hairs of dorsum short and leaf- or scale-like, pointed, with short ciliations. *E. reginae* (Hirst).
   Hairs on dorsum not as above .. .. 2.
2. Anterior end of crista with a long nasus. Dorsal hairs long and spiniform, pointed, and only indistinctly ciliated. Tarsus of palp short, not longer than wide .. .. *E. celeripes* (Rainbow).
   Anterior end of crista without nasus. Palpal tarsus long and clubbed .. 3.
3. Dorsal hairs fine and tapering to a point, of more uniform size. *E. pilosus* (Hirst).
   Dorsal hairs stouter and blunt, not tapering to a point, of variable length. *E. urrbrae* sp. nov.

LEPTUS Latreille, 1795.

This genus differs from *Belaustium* in the eyes being placed before the middle of the crista, the crista being without any shield, the absence of a nasus, and in the structure of the dorsal body hairs.

LEPTUS WARREGENSE (Hirst, 1928).

Syn. *Belaustium warregense* Hirst, 1928.

The syntypes of this species were found amongst the Hirst material in Adelaide, and are now in the South Australian Museum. The following redescription and figures are drawn from the syntypes:

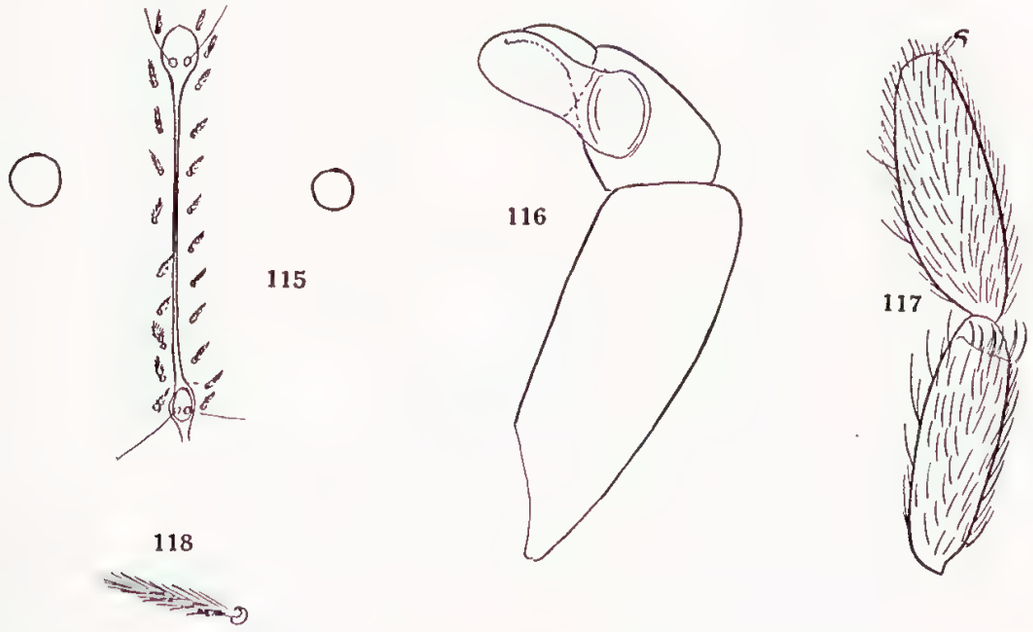

Fig. 115–118. *Leptus warregense* (Hirst): 115, crista and eyes; 116, palp; 117, front tarsus and metatarsus; 118, dorsal seta.

Redescription: Length 1·575 mm. Crista well developed, linear, 440 μ long, without shield, anterior and posterior sensillary areas each with the usual pair of sensory hairs. Eyes one on each side, placed slightly behind the anterior sensillary area. Palpi as figured, with small tibial claw and long, clubbed tarsus overreaching tip of claw. Legs not longer than body, I 1,660 μ, II 1,050 μ, III 1,225 μ, IV 1,450 μ; front tarsus 300 μ long by 110 μ high, metatarsus 275 μ long, all tarsi without scopulae. Hairs on legs long, pointed, and strongly ciliated; on dorsum 35–40 μ long, strongly feathered, rather blunt, and not as bushy as in the following species.

LEPTUS ORNATUS sp. nov.

Description: Small, length 1·35 mm., width 0·9 mm. Colour in life reddish. Crista distinct and well developed, 420 μ long, with anterior and posterior sensillary areas each with the usual pair of sensory hairs, anterior area of crista

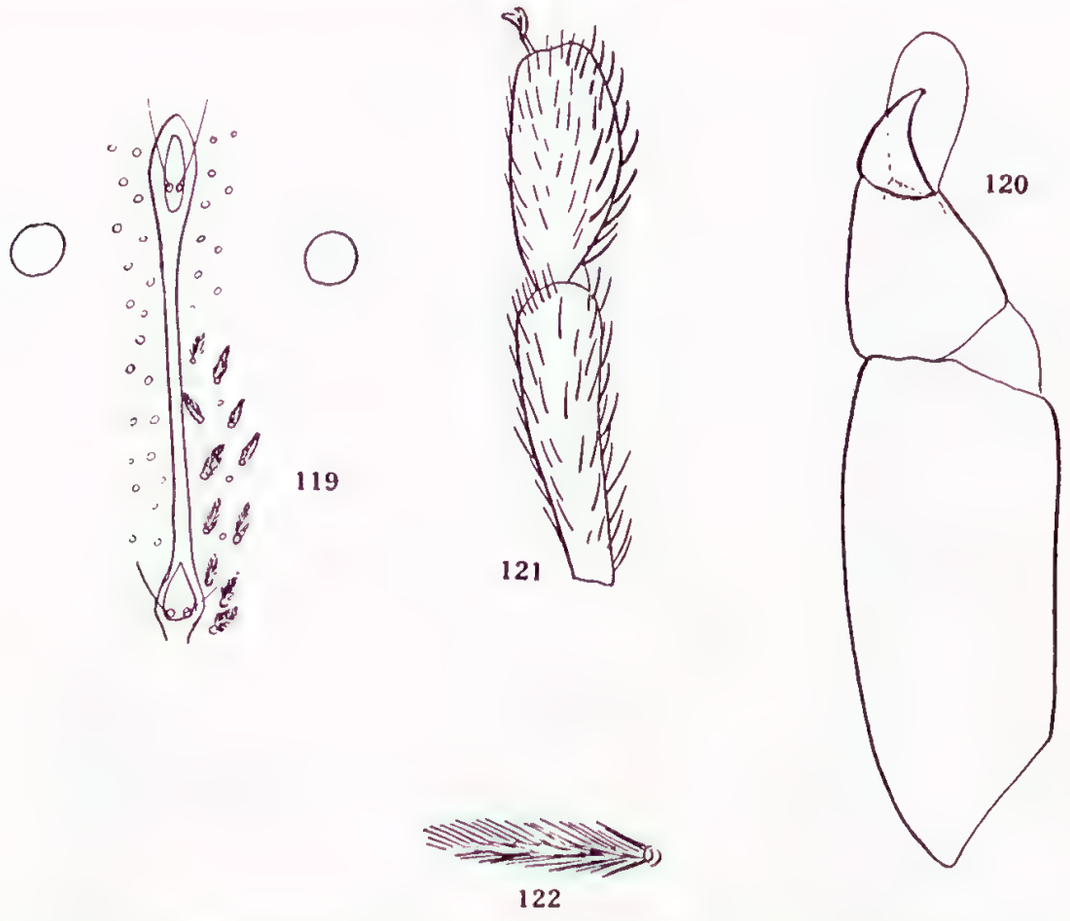

Fig. 119–122. *Leptus ornatus* n.sp.: 119, crista and eyes; 120, palp; 121, front tarsus and palp; 122, dorsal seta.

elliptical but without nasus. Eyes one on each side, placed just behind the anterior sensillary area. Palpi as figured, with strong but small tibial claw and long and stout tarsus scarcely clubbed but overreaching tip of claw. Legs I and IV slightly longer than the body, I 1,500 μ long, II 900 μ, III 1,200 μ, IV 1,650μ, front tarsus short and elliptical, 260 μ long by 120 μ high, metatarsus rather longer, all tarsi without scopulae. Dorsal body hairs short and thick, 27 μ long, slightly curved, strongly feathered so as to appear bushy, mainly very dark, but there appears to be a medial patch where these hairs are light.

Type: From Rottnest Island, West Australia, January 31, 1931, collected by myself.

The above specimens are now in the South Australian Museum. This species can be distinguished from the preceding by the structure and dimensions of the front tarsus and the nature of the dorsal clothing.

BELAUSTIUM v. Heyden, 1826.

BELAUSTIUM NEWMANI sp. nov.

Description: Length 1·65 mm., width 1·3 mm. Colour in life reddish. Crista distinct and well developed on a narrow elongate shield, with anterior and posterior sensillary areas, the front area produced into a blunt nasal process, sensory hairs short, about 40μ long, crista 430 μ long. Eyes one on each side,

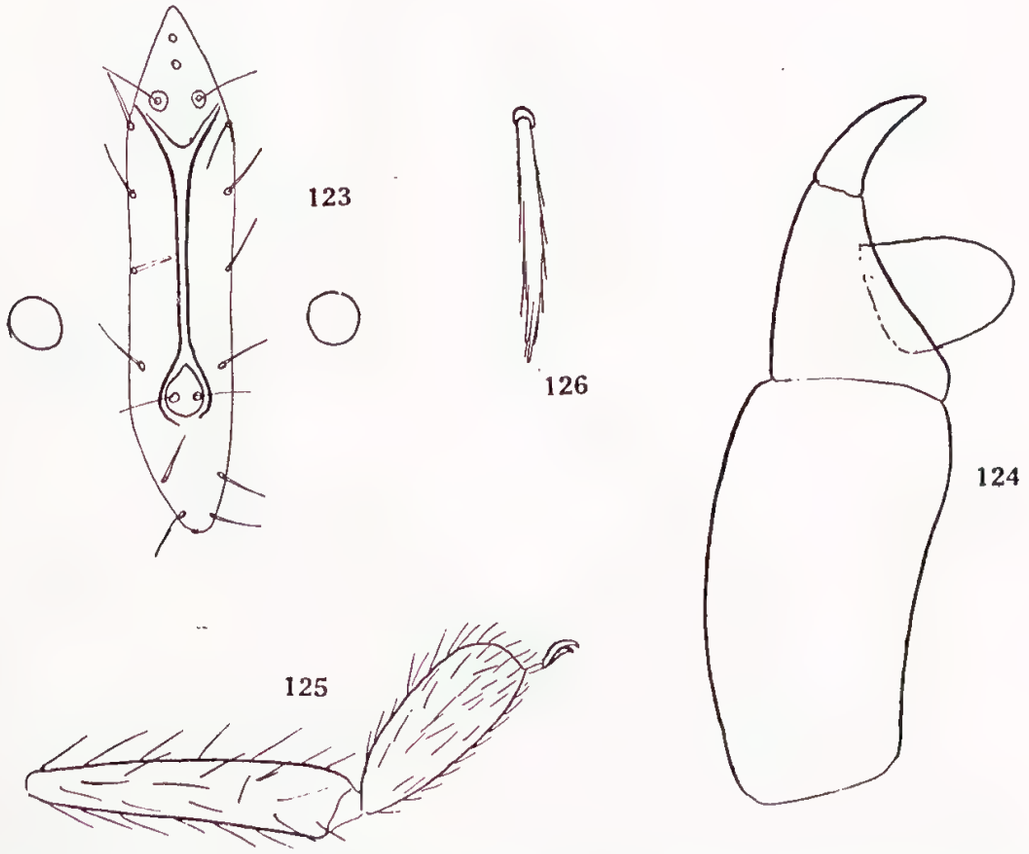

Fig. 123–126. *Belaustium newmani* n.sp.: 123 crista and eyes; 124, palp; 125, front tarsus and metatarsus; 126, dorsal seta.

sessile, placed slightly in front of the posterior and sensillary area. Palpi as figured, with strong, short tibial claw and short, stout tarsus. Legs I and IV scarcely longer than the body, I 1,700 μ, II 1,200 μ, III 1,200 μ, IV 1,860 μ, front tarsus 230 μ long by 95 μ high, metatarsus 360 μ, all tarsi without scopulae. Dorsal setae ciliated as in *B. littorale* sp. nov., but stouter and straighter and apically blunt, sparser and more scattered.

Type and *paratype:* Perth, West Australia, collected by myself in 1931, now in the South Australian Museum. This species is named after Mr. L. J. Newman, Government Entomologist to West Australia as a slight mark of esteem.

BELAUSTIUM GLAUERTI sp. nov.

Description: Length 1·16 mm., width 1·75 mm. Crista distinct and well developed on an elongate shield, with anterior and posterior sensillary areas, each with the usual pair of sensory hairs. Length of crista 330 μ, of shield 430 μ, the anterior sensillary area produced in a blunt nasus, from the tip of which the

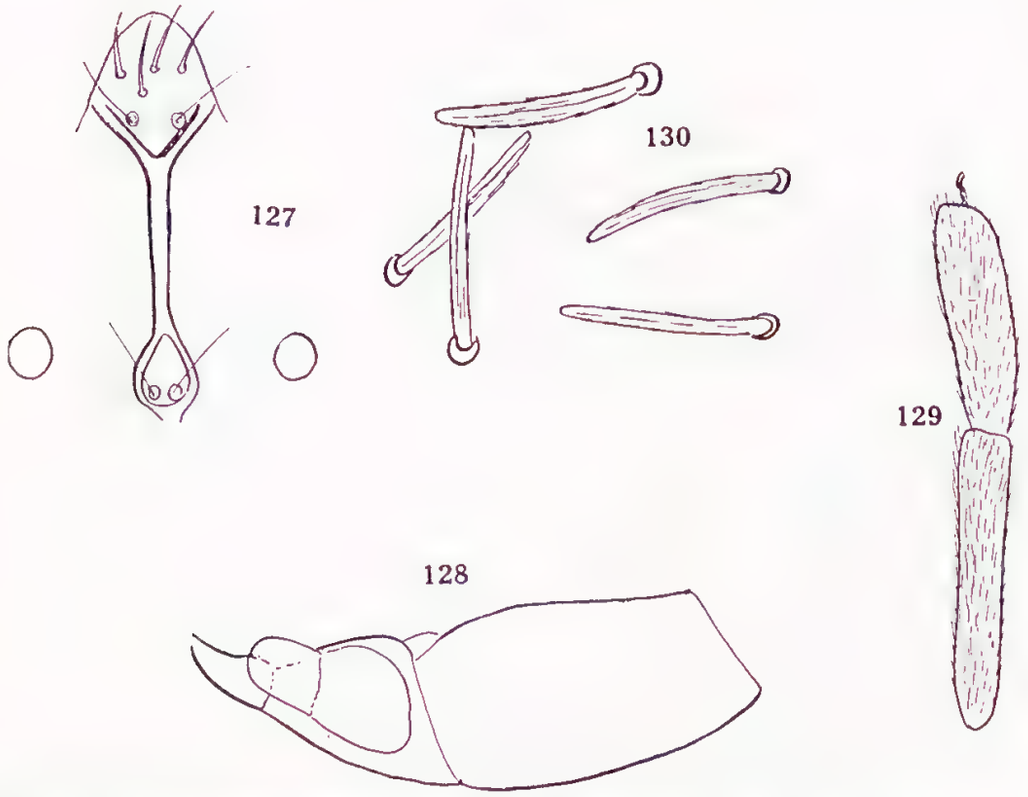

Fig. 127–130. *Belaustium glauerti* n.sp.: 127, crista and eyes; 128, palp; 129, front tarsus and metatarsus; 130, dorsal setae.

length of the crista is taken. Sensory hairs 115 μ long. Eyes one on each side, sessile, on a level with the posterior sensillary area. Palpi as figured. All legs longer than the body, I 2,820 μ, II 1,600 μ, III 1,760 μ, IV 2,820 μ, front tarsus 420 μ long by 110 μ high, metatarsus 490 μ long, all tarsi without scopulae. Dorsal hairs sparse and short, 30 μ long, not tapering, and more blunt than in previous species, indistinctly ciliated.

Type: A single specimen from Perth, West Australia, collected in 1932 by myself. The specimen is now in the South Australian Museum. It is named in honour of Mr. L. J. Glauert, Curator of the Perth Museum.

BELAUSTIUM LITTORALE sp. nov.

Description: Small, reddish. Length 2·4 mm., width 1·35 mm. Crista well developed, linear but thick, on a narrow elongate shield, with anterior and pos-

terior sensillary areas each with the usual pair of sensory hairs. The anterior area of crista is produced into a blunt nasus, and the length of the crista from its tip is 650 μ. Palpi as figured, with small, strong tibial claw and short, stumpy tarsus. Eyes one on each side, placed slightly in front of posterior area of crista. Legs not longer than body, I 2,400 μ, II 1,800 μ, III 1,850 μ, IV 2,500 μ, front tarsus elliptical, 300 μ long by 150 μ high, metatarsus 420 μ long, all tarsi without scopulae. Dorsal body hairs long, 60 μ, curved, slender and pointed, with ciliations on one side only, fairly numerous in good specimens.

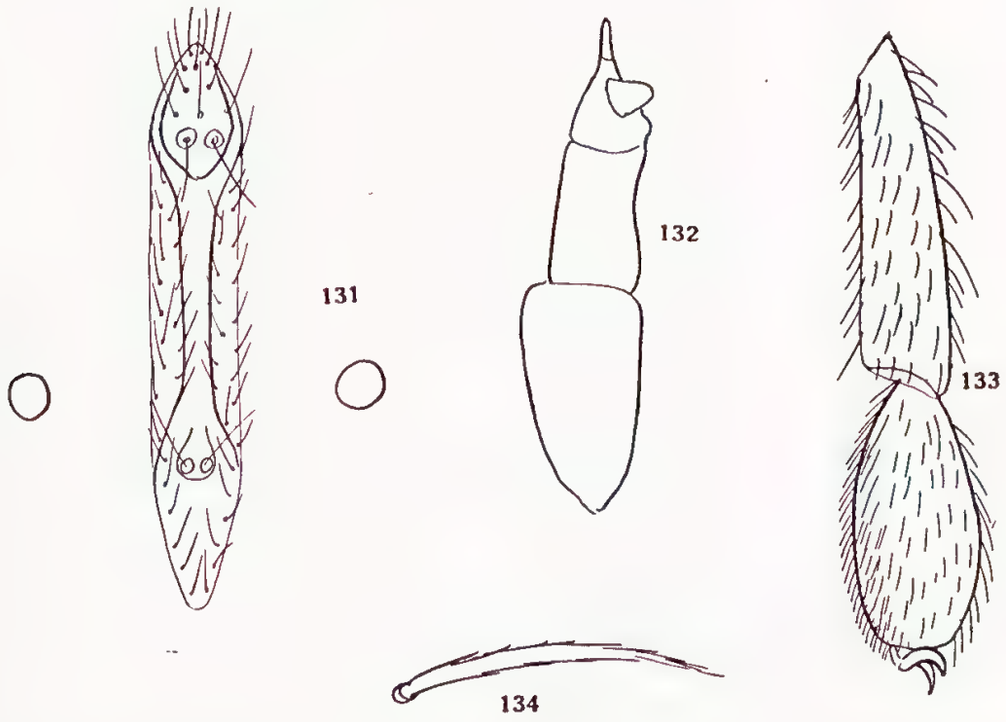

Fig. 131–134. *Belaustium littorale* n.sp.: 131, crista and eyes; 132, palp; 133, front tarsus and metatarsus; 134, dorsal seta.

Type and *paratypes* in the South Australian Museum, and collected under seaweed on shore at Point Perron, West Australia, April 6, 1931, by the writer.

Remarks: This species is very close to the European species *B. quisquiliarum* (Herman), as ascertained by comparison with an English specimen of that species. Herman's species has slightly shorter and perfectly plain setae on the dorsum.

BELAUSTIUM BREVUM sp. nov.

Description: Length 1·245 mm., width 0·83 mm. Crista distinct but shield rather obscure. Anterior and posterior sensillary areas present, anterior with a slight nasus. The sensory hairs of the crista are 115 μ long, the crista itself 320 μ. Eyes one on each side, sessile, and placed behind the middle of the crista. Legs I and IV rather longer than the body, I 1,500 μ, II 1,060 μ, III 1,245 μ,

IV 1,660 μ, front tarsus 260 μ long by 130 μ high, metatarsus 290 μ long, all tarsi without scopulae. Dorsal body hairs sparse, 75 μ long, fairly thick and bluntly pointed, slightly ciliated.

Type: A single specimen from Riverton, South Australia, September, 1933. collected by Mr. W. G. Johnston; in the South Australian Museum.

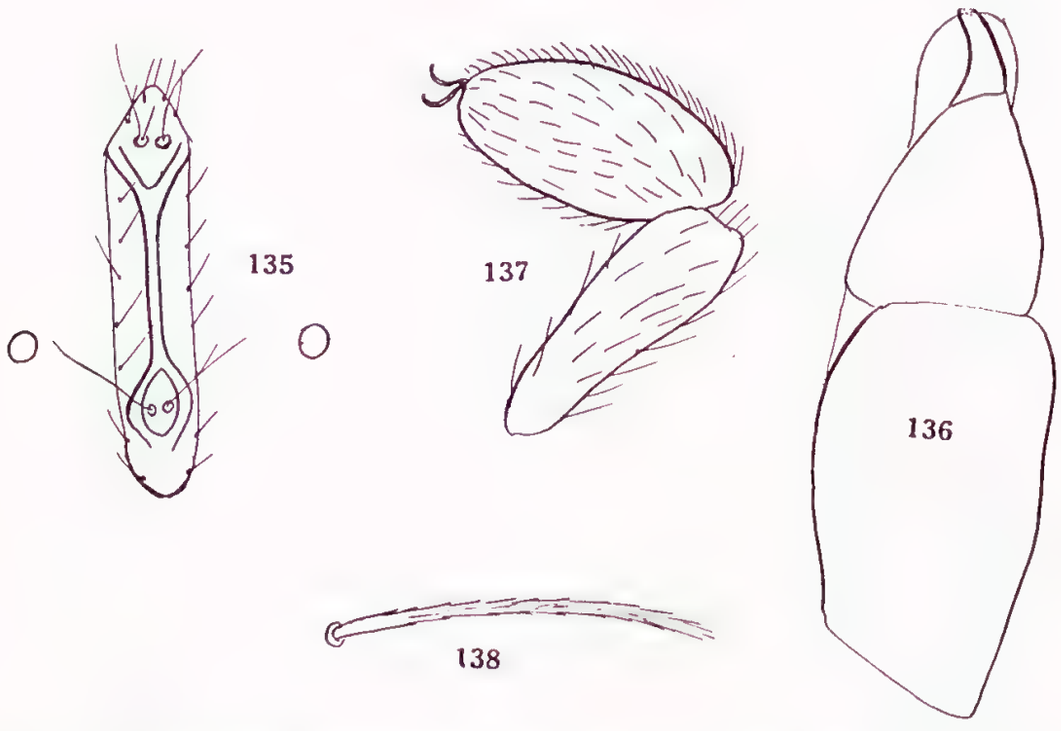

Fig. 135–138. *Belaustium brevum* n.sp.: 135, crista and eyes; 136, palp; 137, front tarsus and metatarsus; 138, dorsal seta.

BELAUSTIUM RIPICOLA sp. nov.

Description: Length 700 μ, width 350 μ. Colour in life bright red. Crista distinct with anterior and posterior areas, but with hardly any indication of a shield. Each area of the crista has the usual pair of sensory hairs, which are very finely ciliated. Length of crista 150 μ and of sensory hairs 45 μ. The front area of crista forms a small nasus furnished with a few long setae. Eyes one on each side in a line with the posterior sensillary area. There is a very distinct suture behind the cephalothorax. Palpi long and straight, as figured. Legs I 610 μ long, II 400 μ, III 435 μ, IV 570 μ, front tarsus elliptical, 110 μ long by 43 μ high, metatarsus 90 μ long. Clothing of moderately numerous pointed, curved setae, 20 μ in length, and under a high power slightly ciliated.

Locality: Amongst herbage on banks of Hindmarsh River, Victor Harbour, South Australia, in January, 1934 (H.W.).

Syntypes: In the South Australian Museum.

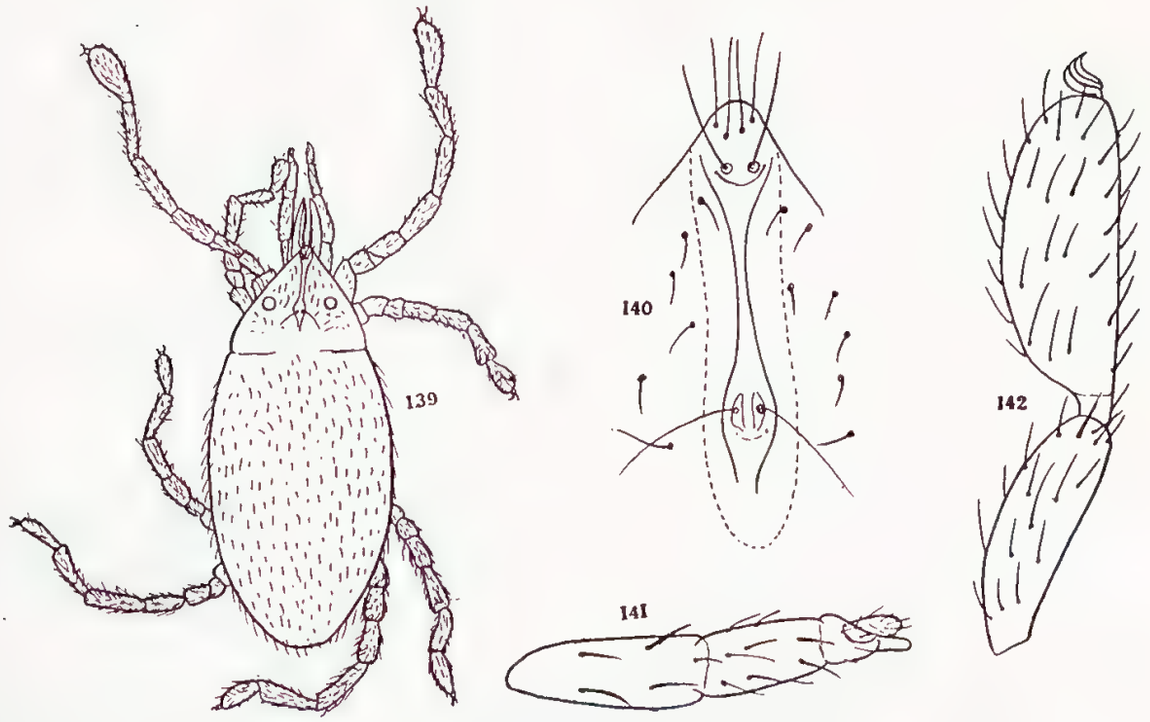

Fig. 139–142. *Belaustium ripicola* n.sp.: 139, dorsal entire view; 140, crista; 141, palp; 142, front tarsus and metatarsus.

BELAUSTIUM INSULARUM sp. nov.

Description: Length 810 μ. Colour in life reddish. Crista well developed but shield indistinct, with anterior and posterior sensillary areas each with the

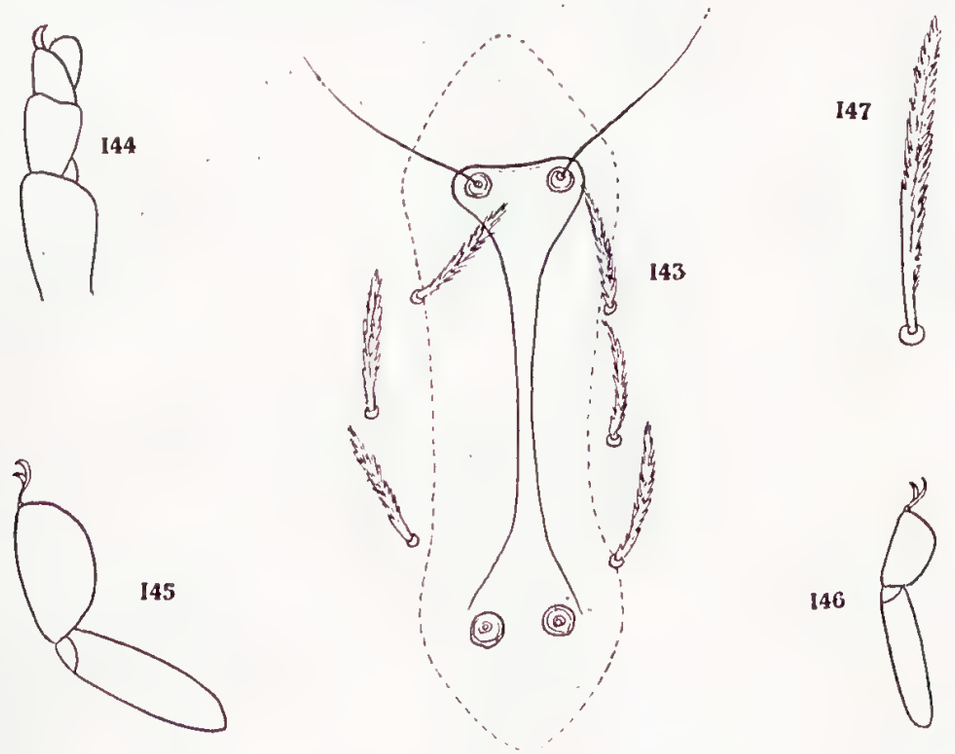

Fig. 143–147. *Belaustium insularum* n.sp.: 143, crista; 144, palp; 145, front tarsus and metatarsus; 146, second tarsus and metatarsus; 147, dorsal seta.

usual pair of sensory setae. Length of crista 380 μ, between sensillae 130 μ. Legs I 800 μ long, II 725 μ, III 750 μ, IV 1,010 μ, front tarsus elliptical, 130 μ long by 82 μ high, metatarsus 180 μ long. Dorsal setae fairly numerous, stout, a little wider at some distance from base, strongly ciliated, and 35–40 μ long.

Type: A single specimen collected on Rottnest Island, West Australia, January 31, 1931 (H.W.).

Remarks: This species is very closely related to *B. brevum* sp. nov., but differs in the structure of the dorsal setae and the proportions of the front tarsi.

KEY TO THE AUSTRALIAN SPECIES OF BELAUSTIUM.

1. Front tarsus elongate, almost parallel-sided, nearly 4 times as long as high, rather more than 4/5 the length of metatarsus. Dorsal hairs fairly long, indistinctly ciliated, blunt ended. Legs I and IV more than twice as long as body .. .. *B. glauerti* sp. nov.

   Front tarsus short and elliptical .. .. 2.

2. Front tarsus at least 2½ times as long as high .. .. .. 3.

   Front tarsus not more than twice as long as high .. .. .. 4.

3. Front tarsus 2½ times as long as high, metatarsus more than twice as long again. Dorsal hairs stout, tapering, indistinctly ciliated, almost straight and sparse. Legs I and IV only slightly longer than body. *B. newmani* sp. nov.

   Front tarsus slightly more than 2½ times as long as high, metatarsus shorter than tarsus. Clothing of moderately numerous pointed setae, 20 μ long, and indistinctly ciliated. Legs I and IV shorter than body *B. ripicola* sp. nov.

4. Front metatarsus only very slightly longer than tarsus. Body hairs stout, not tapering, but parallel-sided, blunt at apex and slightly ciliated. Small species 1·25 mm. .. .. *B. brevum* sp. nov.

   Front metatarsus quite half as long again as the tarsus .. .. 5.

5. Body hairs slender, curved, and pointed, only indistinctly ciliated. Larger species up to 2·5 mm. .. .. *B. littorale* sp. nov.

   Body hairs stout, strongly ciliated, and broadest at some distance from base. small species 0·8 mm. .. .. *B. insularum* sp. nov.

SPHAEROLOPHUS Berlese, 1910.

This genus is very close to *Belaustium* v. Heyden, 1826, from which it differs chiefly in the almost spherical and large tarsus of the palp. The crista is linear on a narrow shield, and has the usual two pairs of swollen areas at the extremities, each with two sensory hairs. The eyes are one on each side, placed behind the middle of the crista. The dorsal hairs are somewhat spiniform and only indistinctly ciliated.

No species has previously been recorded from Australia.

SPHAEROLOPHUS WESTRALIENSE sp. nov.

Description: Length 1·425 mm., width 0·83 mm. Colour in life red. Crista well developed on a narrow shield with anterior and posterior sensillary areas, without nasus. Length of crista 330 μ, of sensory hairs 135 μ. Eyes one on each

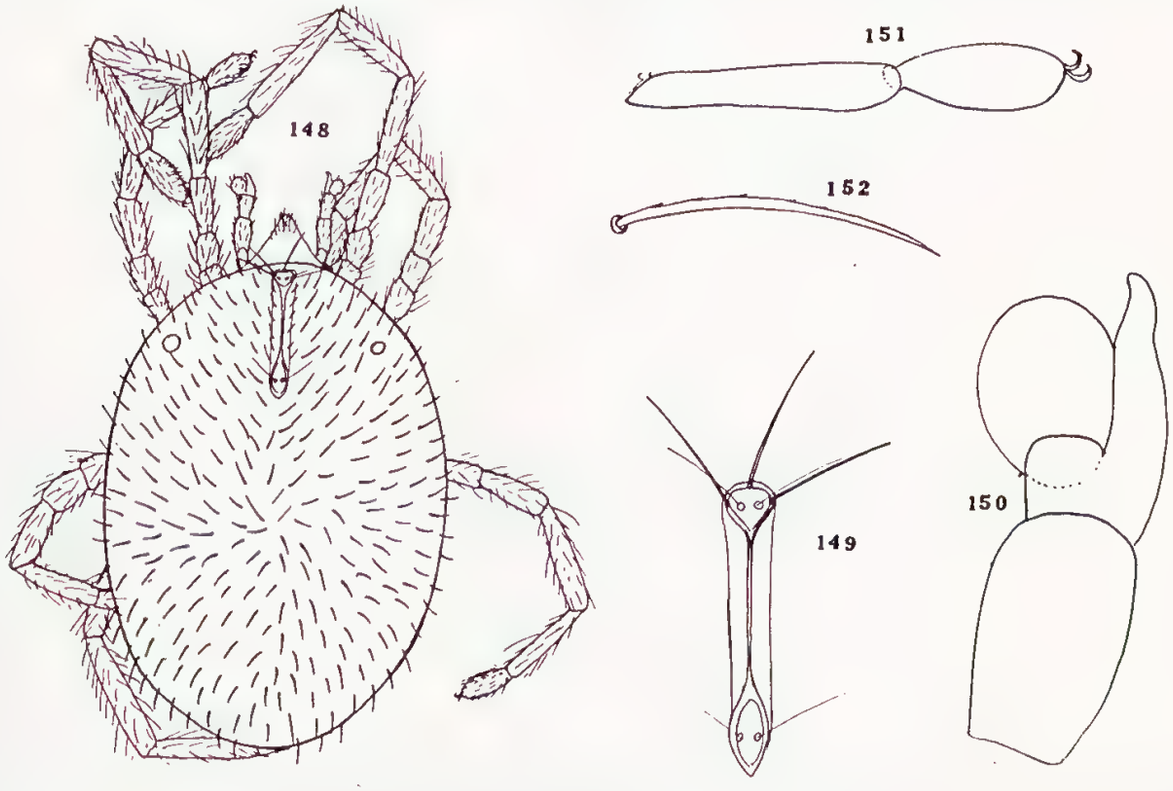

Fig. 148–152. *Sphaerolophus westraliense* n.sp.: 148, dorsal entire view; 149, crista; 150, palp; 151, front tarsus and metatarsus; 152, dorsal seta.

side behind middle of crista and at a considerable distance from it. Legs longer than body in first and fourth pairs, I 1,375 μ long, II 1,000 μ, III 1,080 μ, IV 1,660 μ, front tarsus 180 μ long by 75 μ high, metatarsus 300 μ long. All tarsi with indistinct scopulae. Palpi as figured. Body hairs long, finely pointed, slightly curved, and indistinctly ciliated, variable in length to 110 μ, fairly numerous.

Type and *paratype* from Bridgetown, West Australia, December 3, 1930, collected by the writer, and now in the South Australian Museum.

MICROSMARIS Hirst, 1926.

This genus was erected in 1926 by Hirst, when he described *Microsmaris mirandus* (6) from Christchurch, New Zealand. In 1928 (8) he added a second species, *M. goannae*, from Adelaide, South Australia, but unfortunately without figures and with a very poor and inadequate description. The genotype was, however, well described and figured.

The syntypes of *M. goannae* were found amongst the Hirst material in Professor Harvey Johnston's possession, and have now been placed in the South Australian Museum. Amongst the material collected by the writer while in West Australia, and now in the South Australian Museum, are a number of specimens which belong to this genus. Four of these agree with Hirst's description of *M. mirandus*, while the remaining two are a new species, to which the name *Microsmaris hirsti* is given.

A study of this material enables us to more definitely define the characters of the genus and also to redescribe *M. goannae*.

REDEFINITION OF GENUS MICROSMARIS.

Of comparatively small size. Mouth-parts styliform and but little retractile. Integument only lightly chitinized, devoid of ornamentation, but clothed with small simple spine-like setae. Crista obsolete, but two pairs of sensory hairs present, widely separated. One eye on each side behind the middle of where the crista would be. Legs generally not much longer than the body, unmodified, with simple hairs, tarsi with only indistinct scopulae. Dorsum with two pairs of large sensory pits edged with scale-like setae; one pair of pits situated medially and sublaterally, the other pair closer together and subapical.

MICROSMARIS MIRANDUS Hirst, 1926.

Four specimens collected by the writer at Mullewa, West Australia, in September, 1931, and now in the collections of the South Australian Museum, agree in detail with this species.

MICROSMARIS GOANNAE Hirst, 1928.

This species was described from specimens collected by Miss Joan Cleland and Mr. S. Hirst under Eucalyptus bark in a garden at Adelaide. It is named after Miss Cleland, and the specific name has no relation to the Australian species of *Varanus*. The syntypes were amongst the Hirst material in Adelaide, and are now in the South Australian Museum. In the same material was also a single specimen collected by Hirst at Belair, South Australia, in January, 1928. Numerous examples were also taken from under Eucalypt bark on Mount Osmond, South Australia, February 3, 1934, by the writer.

The following redescription is drawn from the syntypes: Length 1·43 mm. Crista obsolete, but two pairs of sensory hairs present, 152 μ apart, the hairs 70–80 μ long. Eyes one on each side behind the middle of where the crista would

be. Palpi as figured. Legs short, I 1,580 μ long, II 1,030 μ, III 1,180 μ, IV 1,330 μ, front tarsus 170 μ long by 75 μ high, metatarsus 300 μ long. Clothing of numerous short, curved, spine-like setae, 20 μ long and interspersed, especially

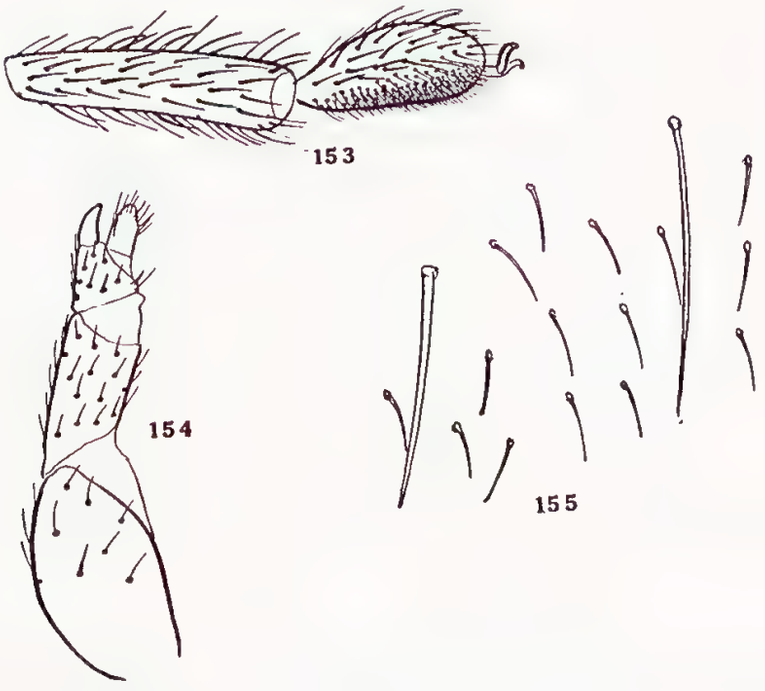

Fig. 153–155. *Microsmaris goannae* Hirst: 153, front tarsus and metatarsus; 154, palp; 155, posterior dorsal setae.

posteriorly, with much longer setae, which reach 70 μ in length. Dorsum with the usual two pairs of sensory pits.

The essential differences of this species from the other two are give in the key.

MICROSMARIS HIRSTI sp. nov.

Description: Length 1·0 mm. Colour in life red. Crista obsolete, but two pairs of sensory hairs present, 112 μ apart and the hairs 70 μ long. Eyes one on each side, behind the middle of where the crista would be. Legs not longer than body, I 1,000 μ long, II and III 830 μ, IV 920 μ, front tarsus 135 μ long by 65 μ high, metatarsus 164 μ long. Palpi as figured. Clothing of numerous short, curved, spine-like setae, 30 μ long, posteriorly the dorsum has some slightly longer but similar setae which reach 40 μ in length. Dorsum with the usual two pairs of sensory pits 35 μ in diameter.

Type: Freshwater Bay, Swan River, Perth, West Australia, November 15, 1930 (H.W.).

Paratype: King's Park, Perth, West Australia, September 5, 1931 (H.W.).

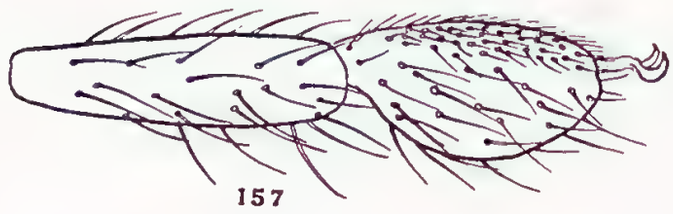

Fig. 156–158. *Microsmaris hirsti* n.sp.: 156, palp; 157, front tarsus and metatarsus; 158, posterior dorsal setae.

MICROSMARIS MINUTUS sp. nov.

Description: Very small species 0·825 mm. long. In life reddish with a distinct green shimmer. Legs I and IV distinctly longer than body, I 1,320 μ,

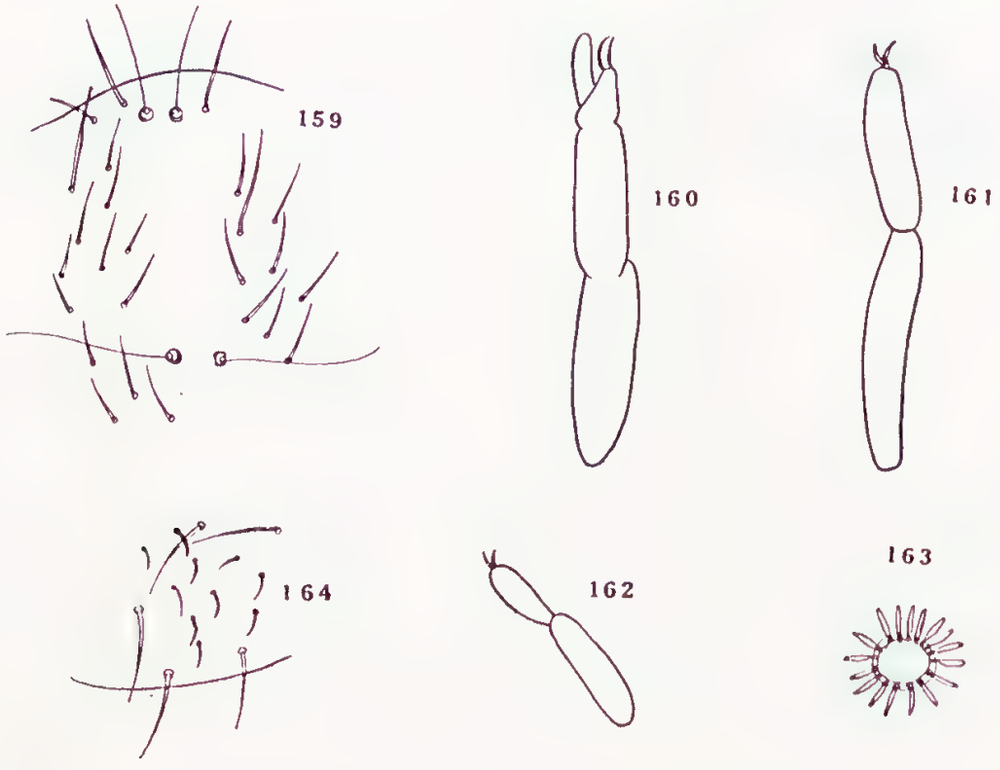

Fig. 159–164. *Microsmaris minutus* n.sp.: 159, anterior portion of dorsum showing sensory hairs; 160, palp; 161, front tarsus and metatarsus; 162, second tarsus and metatarsus; 163, one of the dorsal pits, posterior dorsal setae.

II 660 μ, III 740 μ, IV 1,050 μ, front tarsus more than twice as long as high, 120 μ by 55 μ, metatarsus 260 μ long. Eyes on each side placed medially to the two pairs of sensory hairs. Crista obsolete, but with two pairs of sensory hairs 120 μ apart, anterior hairs 50 μ long, posterior 80 μ long. Dorsum well clothed with two kinds of setae, mostly short, 30 μ long, but interspersed with long ones reaching 55 μ in length. Dorsum with the usual two pairs of pits lined with scale-like setae, but these setae are not so broad as in other species.

Locality: A large number of specimens taken by sweeping herbage on Mount Lofty, South Australia, January 1, 1934 (H.W.).

Syntypes: In the South Australian Museum.

KEY TO THE SPECIES OF MICROSMARIS.

1. Legs I and IV much longer than the body. Small species 0·825 mm. *M. minutus* sp. nov.
   Legs I and IV shorter or not much longer than the body .. .. 2.
2. Dorsal setae sparse, of uniform size, small, about 15 μ long. Front tarsus three times as long as high .. .. .. *M. mirandus* Hirst.
   Dorsum posteriorly with some longer setae .. .. 3.
3. Longer dorsal setae only a little longer than the others. Front tarsus as long as high. The pairs of sensory hairs closer together *M. hirsti* sp. nov.
   Longer dorsal setae about three and a half times as long as the others. Front tarsus slightly more than twice as long as high. The pairs of sensory hairs wider apart .. .. *M. goannae* Hirst.

CALYPTOSTOMA Cambridge, 1875.

Syn. *Smaridia* Latreille, 1817.

Fessonia (v. Heyden) Banks, 1916.

CALYPTOSTOMA PROMINENS (Banks, 1916).

Syn. *Fessonia prominens* Banks, 1916.

The type from Ocean Grove, Victoria, taken by the late Mr. A. M. Lea in association with the ant *Iridomyrmex nitidus*, is in the South Australian Museum collections. Amongst the Hirst material left in Adelaide were four other specimens collected by Hirst at Menindie, South Australia, and labelled in pencil by Hirst as "Banks' genus". A further specimen was found by the writer under bark in the grounds of the Waite Institute, Urrbrae, South Australia, on September 3, 1933. From these additional localities the association of the type specimen with ants would appear to be accidental.

Excellent figures of the cephalothorax and dorsal hairs are given by Banks, but no other details. Drawings of the palp and front tarsus and metatarsus are now added, while certain morphological features are described which are not mentioned in the original description. These details, however, are not taken from the type, which is in poor condition, but from the specimen from the Waite Institute. Another example of this species was collected by myself at Victor Harbour, South Australia, in January, 1934.

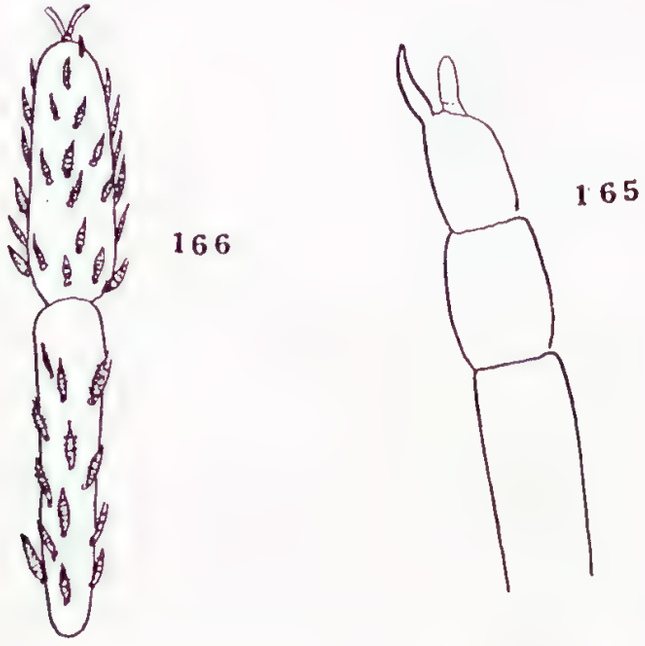

Fig. 165–166. *Calyptostoma prominens* (Banks): 165, palp; 166, front tarsus and metatarsus.

Length 0·65 mm. Palpi as figured, with long, slender claw and shorter but elongate tarsus which is not clubbed. Leg I 670 μ long, II 330 μ, III 330 μ, IV 500 μ, front tarsus (missing in type) 105 μ long by 38 μ high, metatarsus 135 μ. Dorsal hairs 20 μ long.

Genus CAECULISOMA Berlese, 1888.

CAECULISOMA NASUTUM Hirst, 1928.

The type of this species, collected by Mr. A. M. Lea in the Cairns District of Queensland, is in the collections of the South Australian Museum.

The original description is very good, and little needs to be added. As in all species of the genus, however, the crista is continued behind the posterior sensillary area for some distance as a kind of dorsal groove. As no figures accompanied the original description, drawings of the important details are now given. These drawings are all from the type specimen. The front tarsi are missing, but

are probably longer than those of the other legs. The tarsus and metatarsus shown are those of leg IV.

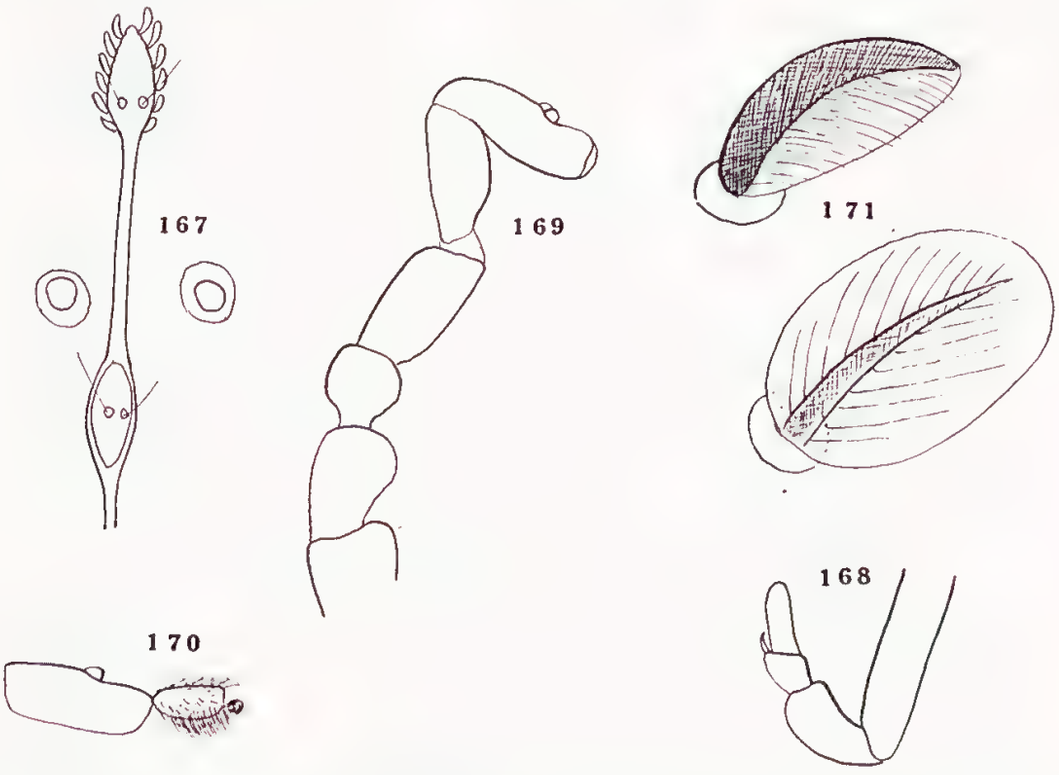

Fig. 167–171. *Caeculisoma nasutum* Hirst: 167, crista and eyes; 168, palp; 169, front leg without tarsus; 170, tarsus and metatarsus of leg IV; 171, two of the dorsal setae.

The species appears to be very closely related to *Caeculisoma tuberculatum* Berlese from Buenos Ayres, but I have not been able to see the original description and figures of this species.

CAECULISOMA MONTANA (Rainbow, 1906).

Syn. *Rhyncholophus montana* Rainbow, 1906.

I am indebted to the authorities of the Australian Museum, Sydney, for the opportunity of mounting and examining the type of this species, which was from Mount Kosciusko, F.C.T. The original description, which was accompanied by a figure of the entire animal only, is quite inadequate, so that it is here redescribed and figured in detail.

Length 3·0 mm., width 1·8 mm. Colour scarlet. Crista long and linear, with a swollen stigmal area at each end; the posterior area is, however, continued backwards for some distance as a dorsal groove. Eyes, said to be two on each side, but in the mount I can see only one, as in other species of the genus, sessile. Palpi long, as figured, with elongate tarsus placed terminally on the tibia and subequal to tibia, tibia with a very small outer claw. Legs shorter than body, all

tibia with tubercles or discs on the middle of the outer edge, the third segment of legs II and III with a distinct constriction, tarsi elliptical, front tarsus twice as long as others. Clothing consists of fairly numerous curved spiniform setae

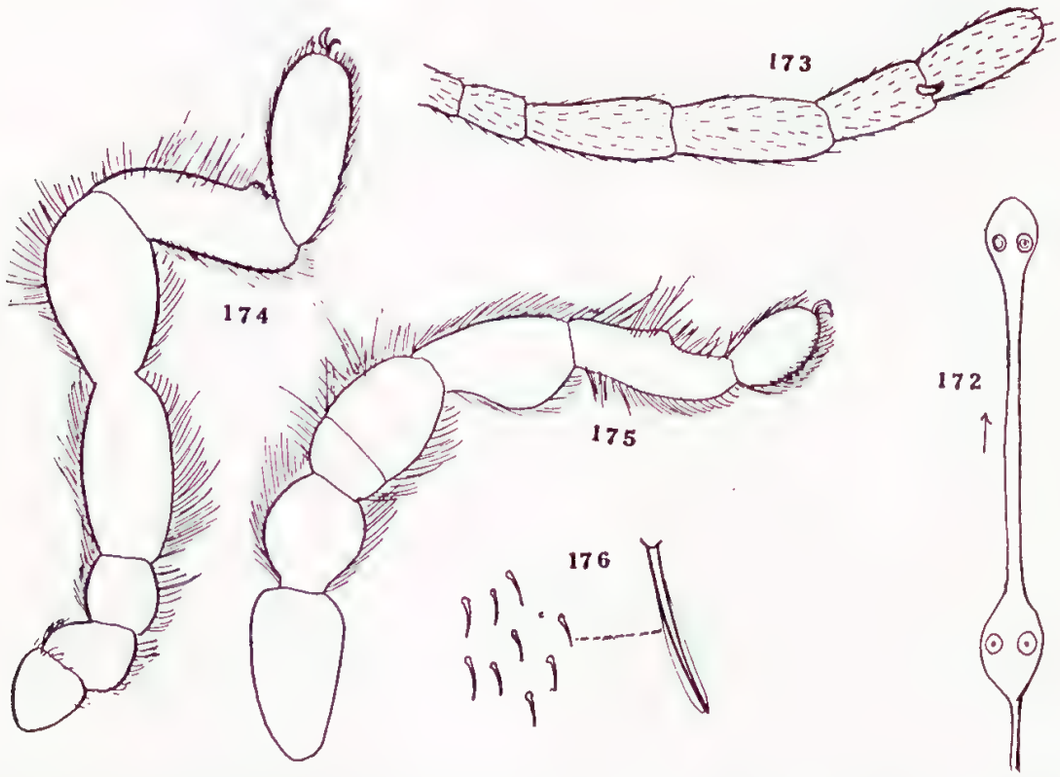

Fig. 172–176. *Caeculisoma montana* (Rainbow): 172, crista; 173, palp; 174, leg I; 175, leg II; 176, dorsal setae.

which taper to a point, but are surrounded by a narrow blunt-ended but delicate sheath. Legs very hairy with long hairs, tarsi with light scopulae.

CAECULISOMA ARGUS Vitzthum, 1926.

Dr. Vitzthum described this species ([17]) from a single example collected by Dr. Dammerman in Sumatra. In the South Australian Museum is a single specimen collected by Mr. R. V. Southcott at Glen Osmond, South Australia, in January, 1934.

This species is easily distinguished by the key.

CAECULISOMA RIPICOLA sp. nov.

Description of Adult: Length 1·17 mm., width 0·875 mm. Colour in life reddish-brown. Crista distinct, with anterior and posterior sensillary areas, the posterior area only a little prolonged backwards. Each area has two sensory hairs, which are comparatively short and simple. The anterior area of the crista has 8–9 long, serrated, scale-like setae. The crista is 350 μ long, sensory hairs

30 μ, and the scale-like setae on anterior area 40 μ long. Eyes one on each side, small, and placed behind the middle line of the crista. Legs I and IV about as long as body, II and III shorter, I 1,130 μ long, II 780 μ, III 875 μ, IV 1,225 μ, front tarsus elliptical, slightly longer than metatarsus, 165 μ long by 96 μ high, metatarsus 152 μ long, second and others much shorter than front and than their respective metatarsi, II–IV with distinct scopulae, all metatarsi with the characteristic discs. Palpi as figured, with small tibial claw, which is much shorter than the tarsus. Clothing of uniform scale-like setae which have longitudinal series of serrations; these scales are very numerous, and are not interspersed with simple spines, their length is 30 μ; the scales are also present on legs II–IV on the outside, beginning at the metatarsi.

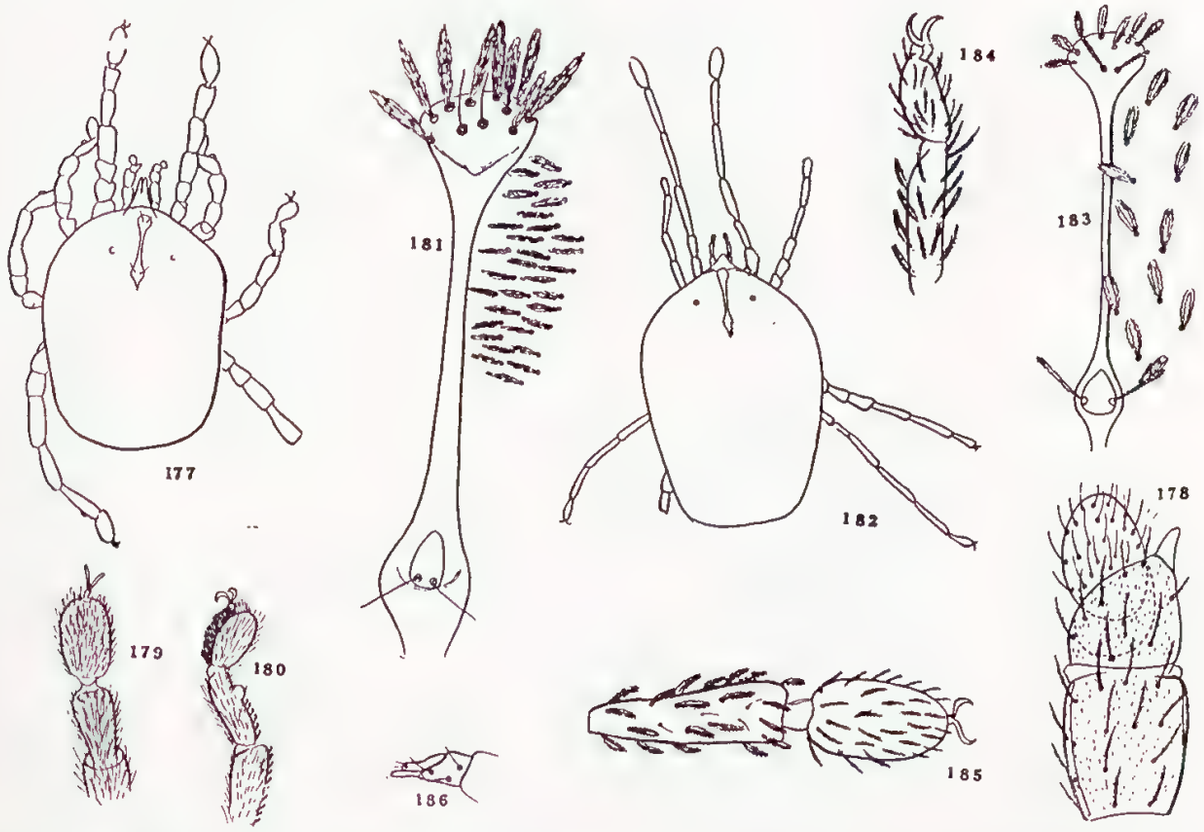

Fig. 177–186. *Caeculisoma ripicola* n.sp.: 177–181 adult: 177, entire dorsal view; 178, palp; 179, front tarsus and metatarsus from above; 180, tarsus and metatarsus of leg II; 181, crista. 182–186 nymph: 182, entire dorsal view; 183, crista; 184, front tarsus and metatarsus; 185; second tarsus and metatarsus; 186, tip of palp.

Description of Nymph: Length 0·875 mm., width 0·560 mm. Colour in life bright red. Crista present and distinct as in adult, but differs in that the sensory hairs are short, finely ciliated and distinctly swollen apically; the anterior sensillary area has fewer scale-like setae which are equal in length to those of the dorsum; length of crista 192 μ, of sensory hairs 35 μ. Eyes one on each side, small, and somewhat behind the median line of the crista. Palpi as figured. Legs very thin, I and IV about as long as body, II and III shorter; front tarsus

92 μ long by 46 μ high, metatarsus 110 μ; all metatarsi are without the discs and there are no tarsal scopulae. Clothing of scale-like setae with longitudinal rows of serrations; these setae, however, are not so numerous as in the adult but of the same type; they are 15 μ long. The relative abundance of these setae on the dorsum of the adult and nymph is shown in the drawings of the crista. Scale-like setae are also present on the legs, but graduate into ciliated pointed setae on the tarsi. Legs I 610 μ long, II 435 μ, III 470 μ, IV 570 μ.

Localities: Only one specimen of the adult was found amongst large numbers of nymphs by sweeping the ti-tree shrubs along the banks of the Hindmarsh River, Victor Harbour, South Australia, in January, 1934 (H.W.).

Remarks: If one is correct in associating the nymphal forms with the single adult specimen, then the character of the metatarsal discs is only to be found in the adult stage of species of this genus. The difference in the sensory hairs of the crista in the two stages is also somewhat remarkable.

The type of the adult and the syntypes of the nymphs are in the South Australian Museum.

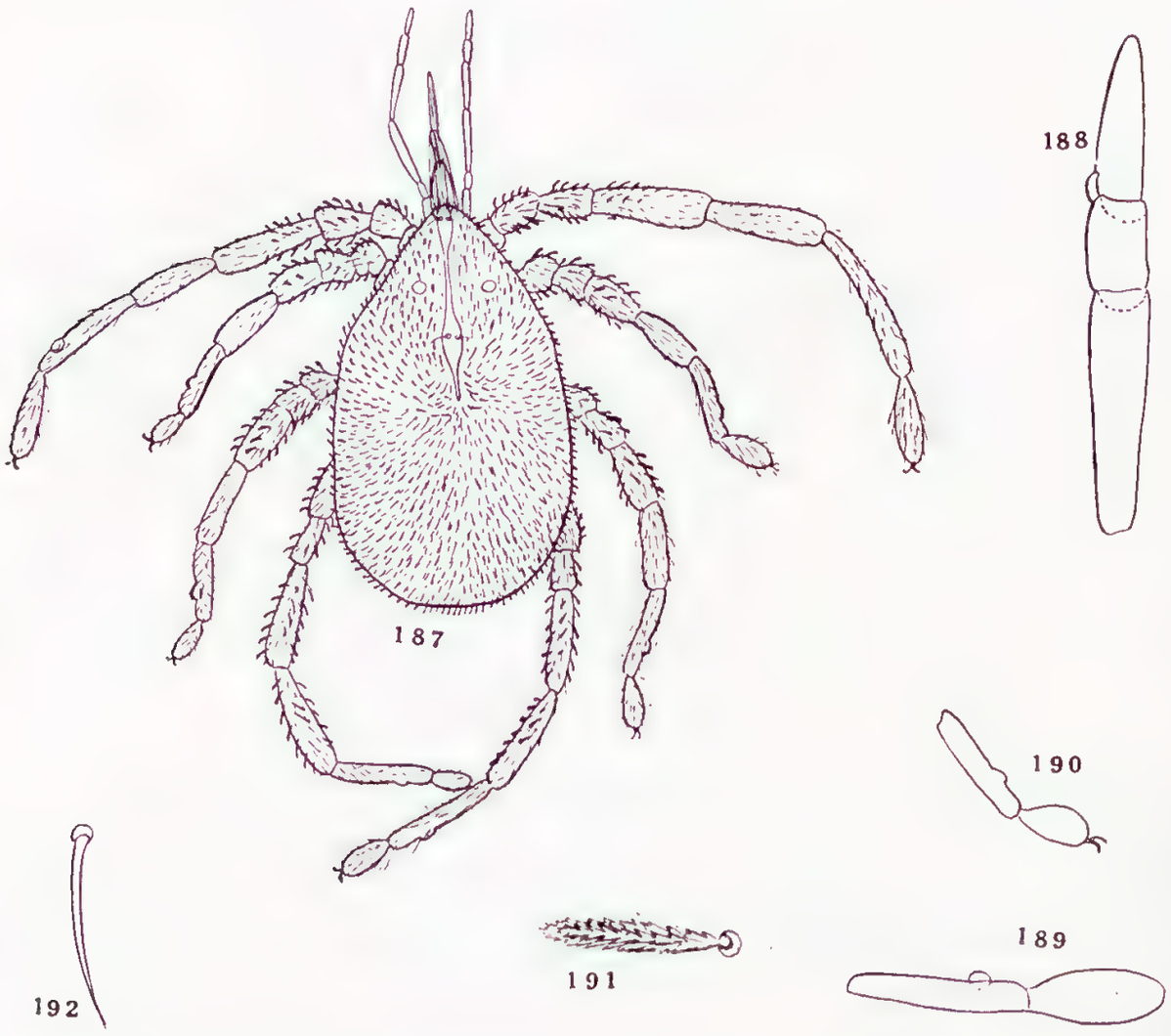

Fig. 187–192. *Cacculisoma johnstoni* n.sp.: 187, entire animal from above; 188, palp; 189, front tarsus and metatarsus; 190, second tarsus and metatarsus; 191, dorsal seta; 192, ventral seta.

CAECULISOMA JOHNSTONI sp. nov.

Description: Length 1·38 mm. Colour red. Body widest in the hinder portion, 0·812 mm. Crista distinct, 800 μ long, with anterior and posterior sensillary area, the posterior area continued for a long distance as a dorsal groove; the distance between the sensory hairs is 415 μ, length of these hairs 50 μ; the anterior area produced into a blunt nasus with about ten long, stout, serrated setae, which are slightly thickened apically. Eyes one on each side, placed in front of posterior sensillary area. Palpi long and thin, 520 μ, tibia with a short outer claw, tarsus longer than tibia. Legs I 2,110 μ long, II 1,300 μ, III 1,460 μ, IV 1,950 μ, front tarsus 290 μ long by 110 μ high, metatarsus 400 μ long; all metatarsi with the usual discs and tarsi II–IV with distinct scopulae. The peculiar discs are also present on the other segments of the legs, as described by Vitzthum for *C. argus*. Clothing dorsally of fairly numerous stout rod-like setae, which are strongly serrated and thickened apically, about 50 μ long; ventrally of plain curved setae of the same length. The stout serrated setae extend on the outside of the legs as far as the basal portion of the tibia.

Type: A single specimen from under bark at Mount Osmond, South Australia, February 3, 1934 (H.W.).

Remarks: This species is named after Professor Harvey Johnston, to whose valued help much of this paper is due.

KEY TO THE AUSTRALASIAN SPECIES OF CAECULISOMA.

1. Dorsal hairs feathered with long secondary hairlets, and interspersed with long, simple, slender spines. Large species 2·5 mm.
   C. sulcatum (Vitzthum, 1926).
   Dorsal hairs not feathered .. .. 2.
2. Dorsal hairs as elongate clubbed papillae with short ciliae.
   C. claviger Canestrini.
   Dorsal hairs not as above .. .. 3.
3. Dorsal hairs scale- or leaf-like .. .. 6.
   Dorsal hairs not so .. .. 4.
4. Dorsal hairs stout rod-like with strong short serrations; ventral hairs simple.
   C. johnstoni sp. nov.
   Dorsal hairs short and curved, spiniform with narrow sheath, of uniform size, not serrated .. .. .. *C. montana* (Rainbow, 1906).
   Dorsal hairs of varying length and not as above .. .. .. 5.
5. Hairs of two distinct sizes, 35 μ and 190 μ, long, cylindrical, uniformly thick with short serrations .. .. .. *C. argus* Vitzthum, 1926.
   Entire animal with long, strong spines, all smooth above but strongly spined on outside .. .. *C. infernale* Vitzthum, 1926.

6. Dorsal hairs scale- or leaf-like, with strongly chitinized mid-rib and a broad, less chitinized, smooth-edged lamella .. *C. nasutum* Hirst, 1928.

Dorsal hairs scale- or leaf-like, with longitudinal rows of serrations. Mid-rib not unduly chitinized.. .. .. .. *C. ripicola* sp. nov.

Genus HIRSTIOSOMA gen. nov.

This genus is somewhat related to *Calyptostoma* and *Caeculisoma*. The body is widest anteriorly. Crista present, with anterior and posterior sensillary areas, each with two sensory hairs. Eyes one on each side on the medial line of the crista. Legs long and fairly thin. All tarsi above the claws with a pair of strong, slightly curved, simple spines arising from distinct papillae. No metatarsal discs. The dorsum is covered with peculiar three-winged short setae.

HIRSTIOSOMA SCALARIS sp. nov.

Description: Length 1·015 mm. Colour red. Body with a constriction medially, 570 μ wide in front of constriction, rather narrower below. Crista distinct, 325 μ long, with anterior and posterior sensillary areas, each with a pair

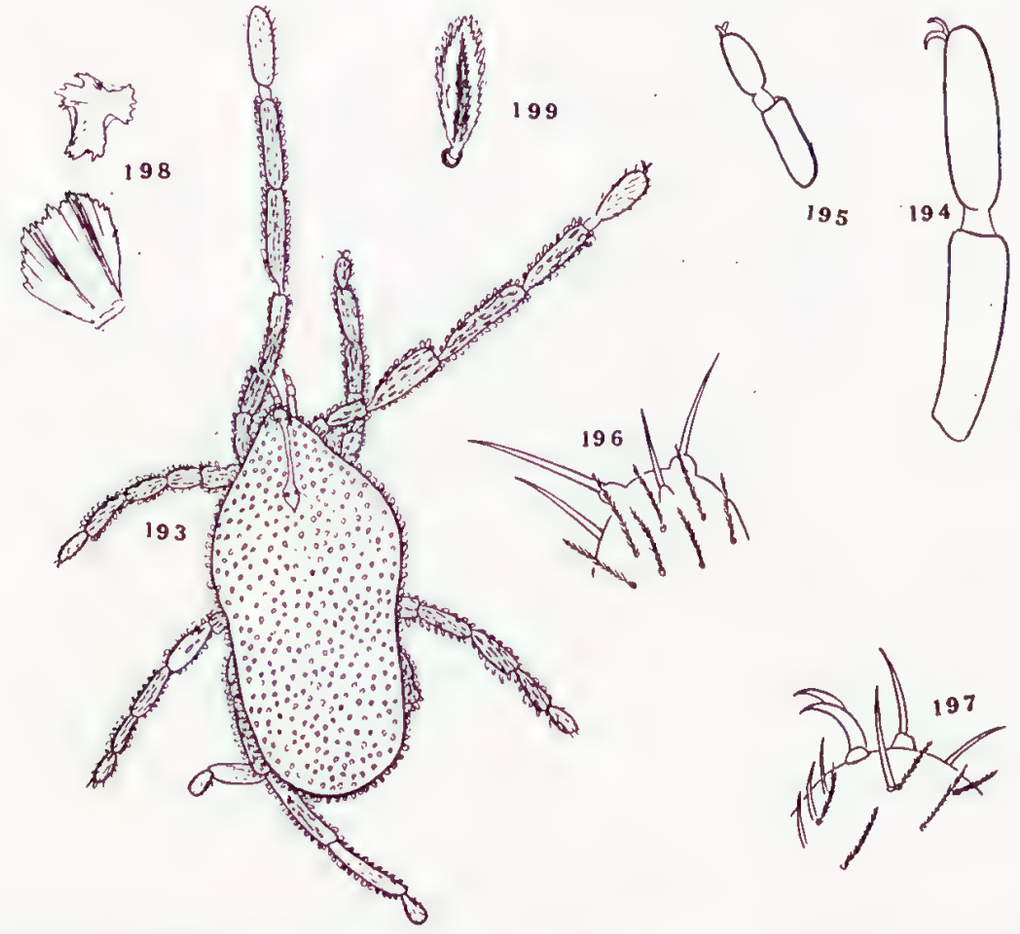

Fig. 193–199. *Hirstiosoma scalaris* n.g., n.sp.: 193, entire animal from above; 194, front tarsus and metatarsus; 195, second tarsus and metatarsus; 196, tip of tarsus from above; 197, tip of tarsus from side; 198, side and top view of dorsal setae; 199, seta from legs.

of sensory hairs about 40 μ long and simple. Eyes one on each side about the middle of crista. Palpi short, tibia with claw which overreaches the thumb-like tarsus, 160 μ long. Apical area of crista with a number of serrated scale-like setae. Legs I 1,100 μ long, II 500 μ, III 500 μ, IV 995 μ, all segments except the tarsi with serrated scale-like setae; all tarsi above the claws with a pair of strong spines arising from distinct papillae, as well as one or two other simple spines, all other hairs feathered. Front tarsus 180 μ long by 54 μ high, metatarsus 210 μ long. Body hairs dorsally and ventrally short, broad, and three-winged, with serrated edges, apically blunt (cf. fig.).

Type: A single specimen taken by sweeping ti-tree bushes on banks of Hindmarsh River, Victor Harbour, South Australia, in January, 1934 (H.W.).

KEY TO THE AUSTRALIAN GENERA OF ADULT ERYTHRAEIDAE.

1. Eyes two on each side .. .. 2.
   Eyes only one on each side .. .. 3.
2. Without crista, only one stigmal area. Gnathosoma drawn out. Legs shorter than body .. .. .. *Calyptostoma* Cambridge, 1875.
   With crista and two sensillary areas. Gnathosoma not unduly drawn out. Legs I and IV often longer than body .. *Erythraeus* Latreille, 1806.
3. All metatarsi in adult with a pair of raised discs on outside. Legs short. Crista produced beyond the posterior sensillary area. Palpi elongate, with long terminal tarsus and minute tibial claw .. *Caeculisoma* Berlese, 1888.
   Metatarsi simple, but tarsi with a pair of stout spines on distinct papillae above claws. Dorsal hairs three-winged .. .. *Hirstiosoma* gen. nov.
   Tarsi and metatarsi simple .. .. 4.
4. Clothing rather sparse. Dorsum with two pairs of rather large sensory pits. *Microsmaris* Hirst, 1926.
   Clothing more abundant. No dorsal sensory pits .. .. .. 5.
5. Eyes placed in front of middle of crista .. .. *Leptus* Latreille, 1795.
   Eyes placed behind the middle of the crista .. .. .. 6.
6. Tarsus of palp large and almost spherical .. *Sphaerolophus* Berlese, 1910.
   Tarsus of palp more elongate, clubbed or not *Belaustium* v. Heyden, 1826.

LARVAL FORMS OF ERYTHRAEIDAE.

ERYTHRAEUS Latreille, 1806.

Dorsal shield as a rule broader than long and without a crista, in addition to the sensory hairs with 4–10 thickly ciliated setae; five-sided to round. One eye on each side. Claw of palp more or less forked, without ventral tooth. Mandible with strong curved claw. Galea dorsally with one pair of hairs. Coxae I and II

separated, each coxa with one hair, between the second pair of coxae with a pair of hairs, and between the third pair another pair of hairs.

ERYTHRAEUS PERTHENSE sp. nov.

Description: Dorsal scutum with anterior margin depressed from the anterior corners, slightly sinuate, with three pairs of thickly ciliated hairs of equal length, the most anterior pair at the extreme lateral corners, the others equally spaced therefrom and close together. Remaining portion of scutum round. Posterior pair of sensory hairs on the posterior edge of scutum, anterior pair only just

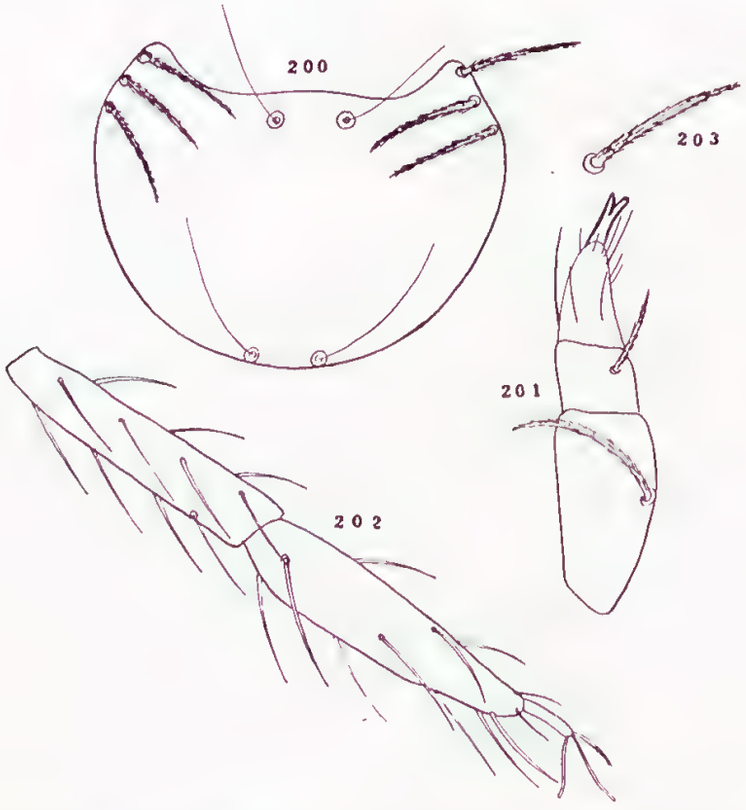

Fig. 200–203. *Erythraeus perthense* n.sp.: 200, dorsal scutum; 201, palp; 202, front tarsus and metatarsus; 203, hair of dorsal scutum.

within the anterior edge. Eyes one on each side. Dorsum with about 10 rows of 10 short, slightly curved setae in each. These setae appear to be simple, but under high magnification are delicately ciliated. Palpi typical of the genus, as figured, basal segment with a long, curved, feathered seta, next segment with a shorter and straight feathered seta, tibia and tarsus with apparently simple hairs. Palpal claw strong and bifid. Front tarsus and metatarsus subequal, with long, simple setae. Tarsal claws three, the hinder one ciliated, pulvilliform. Length of animal 750 μ, of scutum 66 μ, width of scutum 92 μ, length of sensory hairs 80 μ, of ciliated scutal hairs 35·5 μ, of dorsal hairs 27 μ. Length of front legs 415 μ, middle legs 415 μ, hind legs 415 μ, coxae with one seta.

Habitat: King's Park, Perth, West Australia, September 5, 1931.
Type: In the South Australian Museum.

ERYTHRAEUS BUFORANIUS sp. nov.

Description: Dorsal scutum almost round with but slight anterior angles, with three pairs of fairly long, heavily ciliated hairs. Anterior pair of sensory hairs placed at some distance behind the anterior margin of scutum, posterior

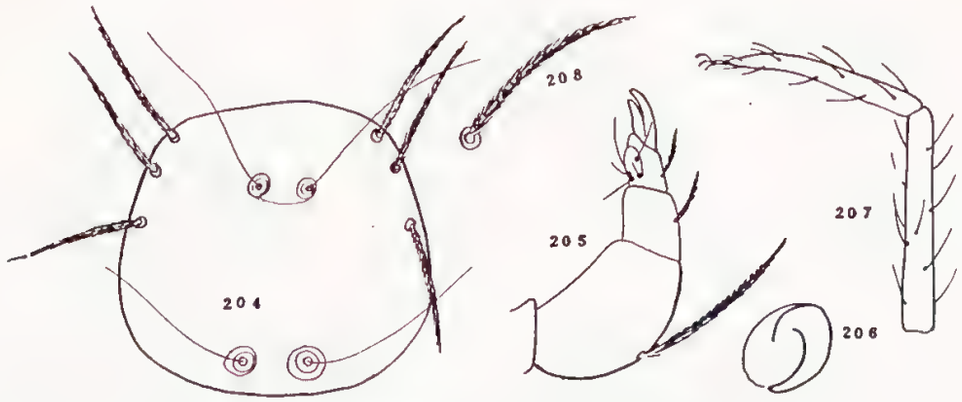

Fig. 204–208. *Erythraeus buforanius* n.sp.: 204, dorsal scutum; 205, palp; 206, claw of mandible; 207, front tarsus and metatarsus; 208, dorsal body seta.

pair subposterior. The hind pair of the ciliated hairs is quite twice as far behind the second that these are behind the first. Eyes one on each side. Dorsal body setae long, slightly curved, pointed, and strongly ciliated, in about 10 rows of 10 each. Palpi typical of the genus, as figured, with a feathered hair on each of the first three segments, tarsus with apparently simple hairs, claw bifid apically. Front tarsus slightly shorter than metatarsus, long and thin, with long simple setae, tarsal claws 3, the hind one pulvilliform. Length of animal 585 μ, width 330 μ, length of scutum 95 μ, width 95 μ, length of sensory hairs 66 μ, of ciliated scutal hairs 42 μ, of dorsal body hairs 30 μ. Front legs 620 μ, middle 620 μ, hind legs 620 μ, front tarsus 135 μ, metatarsus 162 μ, coxae with one hair.

Habitat: On an Acridid (*Buforania* sp.), from Mullewa, West Australia, in September, 1931.

Syntypes: In the South Australian Museum.

ERYTHRAEUS DASYPODIAE sp. nov.

Description: Dorsal scutum longer than broad, 150 μ by 115 μ, with 3 pairs of moderately ciliated hairs 75 μ long, anterior sensory hairs 57 μ long, posterior 115 μ. The posterior sensory hairs are right on the posterior margin of scutum, the anterior sensory hairs in a line with the second pair of ciliated hairs. Palpi

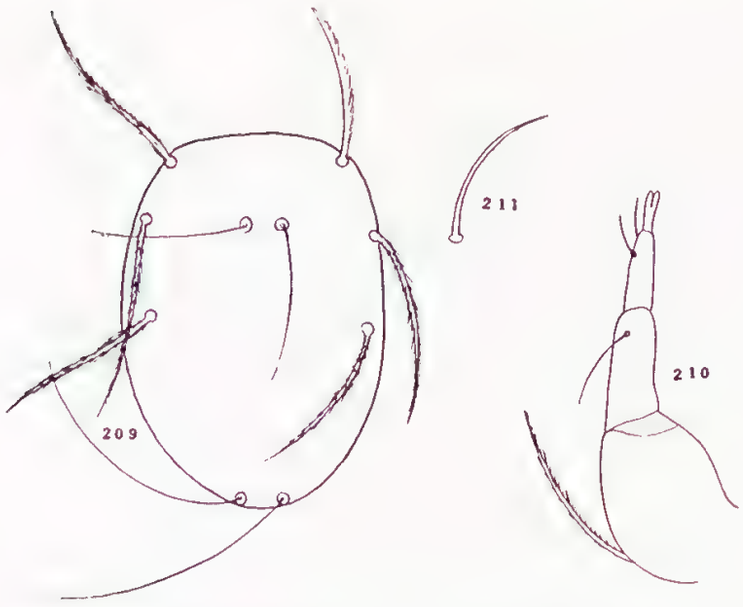

Fig. 209–211. *Erythraeus dasypodiae* n.sp.: 209, dorsal scutum; 210, palp; 211, dorsal seta.

as figured. Claws of mandible strong and strongly curved. Legs uncertain, as the specimens are damaged. Dorsal body hairs sparse, simple, or only very slightly ciliated, 40 μ long. Length of animal 1,825 μ, width 1,500 μ.

Habitat: Two specimens received from Canberra and labelled as "taken on the Peacock Moth".

Syntypes: In the South Australian Museum.

LEPTUS Latreille, 1795.

Syn. *Achorolophus* Berlese, 1891.

Dorsal shield generally broader than long, without crista, besides the sensory hairs with 2–4 thickly ciliated hairs, more or less triangular in shape. Eyes one on each side. Claw of palp simple without ventral or dorsal teeth, palpi not forceps-like. Claw of mandible very minute. Coxae I and II separated, all coxae with one hair and a pair of hairs between each pair of coxae. Hind claw of tarsus pulvilliform.

LEPTUS CHELONETHUS sp. nov.

Description: Dorsal scutum triangular, anterior margin slightly convex, lateral margins slightly concave, corners rounded, with two pairs of stout, comparatively short, and strongly ciliated hairs; posterior pair of sensory hairs quite posterior in position, anterior pair slightly behind the anterior angle, sensory hairs delicately ciliated. Eyes one on each side. Dorsal setae in about 10 rows of 8–10 each, somewhat irregular. These setae are stout rod-like, slightly curved

and strongly ciliated. Palpi straight and typical of the genus, all segments with long ciliated setae, claw simple. Legs long, front tarsus slightly elliptical, a little shorter than the metatarsus and much wider, each with one long, simple seta and many rather short, stout, ciliated setae. Tarsal claws 3, the hinder one pul-

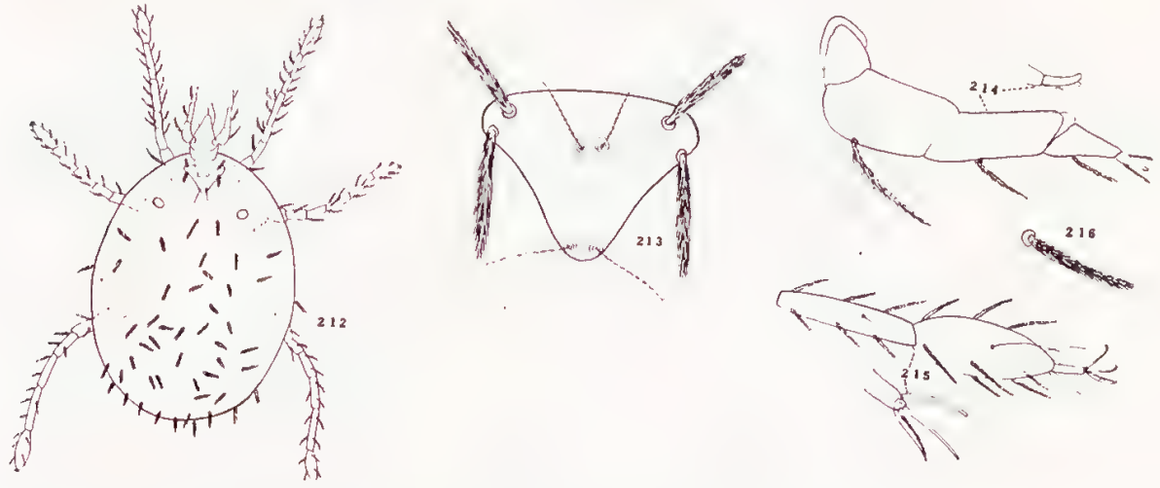

Fig. 212–216. *Leptus chelonethus* n.sp.: 212, entire dorsal view; 213, dorsal scutum; 214, palp; 215, front tarsus and metatarsus; 216, dorsal seta.

villiform. Length of animal 610 μ, width 330 μ. Length of scutum 55 μ, width 66 μ, of sensory hairs 30 μ, of anterior ciliated hairs 33 μ, of posterior ciliated hairs 48 μ. Dorsal body hairs, 42 μ long. Length of front legs 350 μ, tarsus 78 μ by 24 μ high, metatarsus 80 μ, middle legs 330 μ, hind legs 420 μ. All coxae with a single hair.

Habitat: On a Pseudoscorpion from Rottnest Island, West Australia, on January 31, 1931.

Type: In the South Australian Museum.

Remarks: Close to *L. terebrans* Vitz. from Sumatra, but differs in the scutal setae and dimensions of front tarsi.

LEPTUS BATHYPOGONUS sp. nov.

Description: Dorsal shield triangular with well-rounded corners and faint indications of a crista, besides the sensory hairs with two pairs of stout, short, and strongly ciliated hairs, the anterior pair shorter than the posterior pair; the anterior pair of sensory hairs is placed in a line with the anterior pair of ciliated hairs, the posterior pair is subposterior in position. Eyes one on each side. Dorsal body setae in about 10 rows of 6–10 each; these are short, rod-like, and strongly ciliated. Palpi straight as in the genus, each segment with the usual ciliated hairs as figured, claw typical. Legs long, front tarsus long and parallel-

sided, this segment and the metatarsus with one long, simple seta, but this is not as long as in the preceding species, the other setae fairly long and strongly ciliated, tarsal claws 3, the hinder one pulvilliform. Length of animal 660 μ, width 330 μ, length of scutum 80 μ, width 93 μ, sensory hairs 55 μ, ciliated hairs 40 μ. Length of dorsal body hairs 18 μ. Length of front legs 670 μ, tarsus 133 μ, metatarsus 144 μ, middle legs 520 μ, hind legs 680 μ. All coxae with one seta.

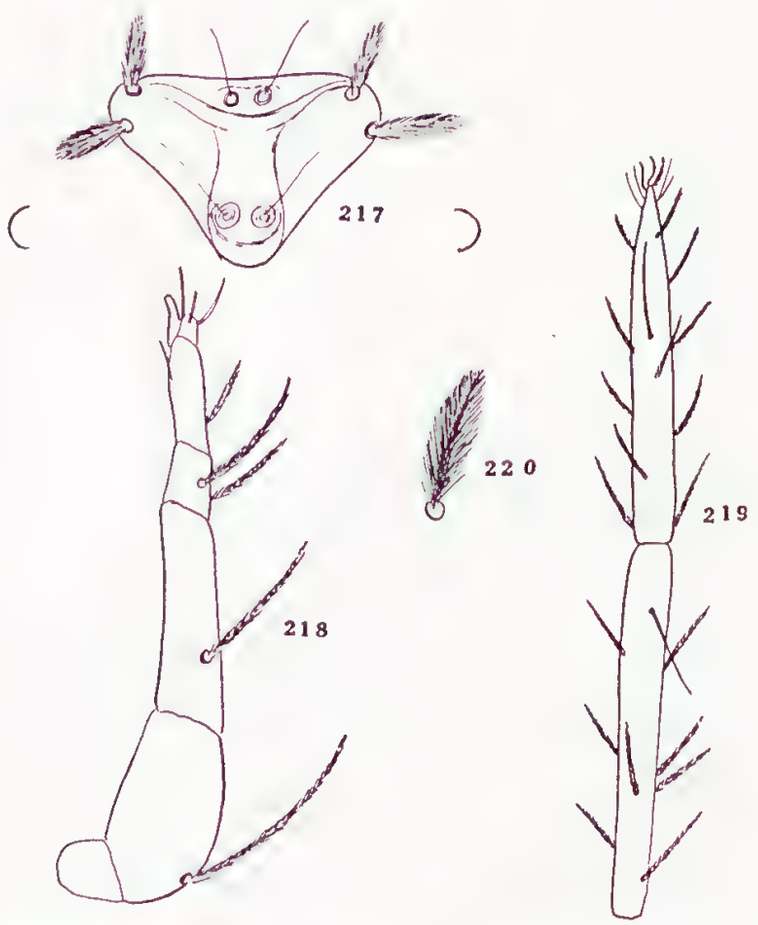

Fig. 217–220. *Leptus bathypogonus* n.sp.: 217, dorsal scutum and eyes; 218, palp; 219, front tarsus and metatarsus; 220, dorsal seta.

Habitat: On an Asilid (*Bathypogonus* sp.), Perth, West Australia, in August 13, 1931 (B.A.O'C.).

Syntypes: In the South Australian Museum.

Remarks: This species is still more closely related to *L. terebrans* Vitz. It has the tarsi of the front pair of legs 8 times as long as high, while in Vitzthum's species they are only 4 times as long.

HAUPTMANNIA Oudemans, 1910.

Dorsal shield generally broader than long, without crista, besides the sensory hairs with 2–10 thickly ciliated hairs, more or less triangular. One eye on each side. Palpi forceps-like, claw without dorsal or ventral teeth, simple, with lateral

accessory tooth. Tarsus of palp with distinct inner claw-like hair. Claws of mandible strongly curved. Coxae I and II separated, all coxae with one hair and a pair of hairs between each pair. Claws 3, the middle thinner and longer, in addition there is a pulvilliform hair.

HAUPTMANNIA WESTRALIENSE sp. nov.

Description: Dorsal scutum rectangular, slightly longer than broad, with two pairs of ciliated hairs in addition to the sensory hairs. The front pair of sensory hairs are situated in a subanterior position and the hinder pair a little behind the

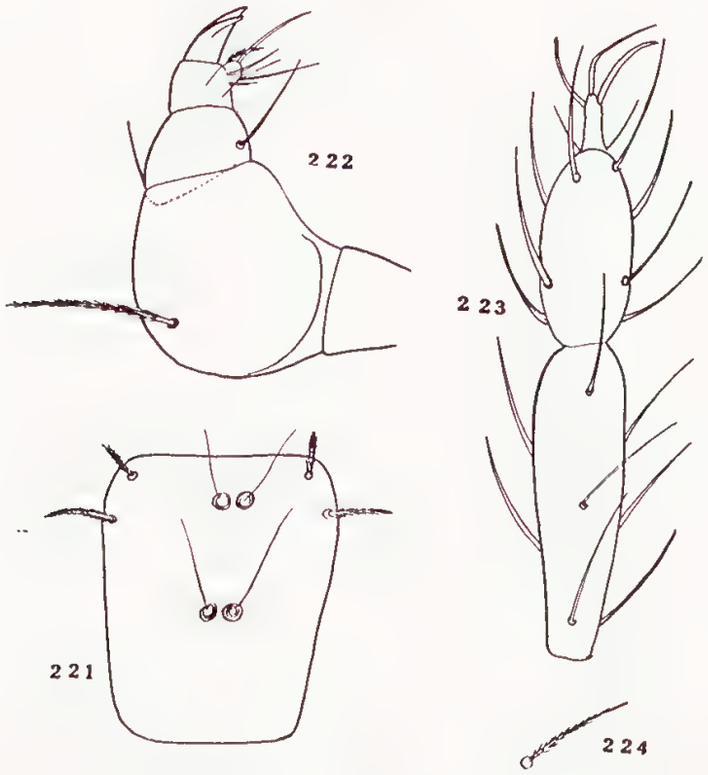

Fig. 221–224. *Hauptmannia westraliense* n.sp.: 221, dorsal scutum; 222, palp; 223, front tarsus and metatarsus; 224; dorsal seta.

medial line. The anterior ciliated hairs are sublateral in position, and the posterior pair lateral and a little behind the front sensory hairs. Eyes one on each side. Palpi forceps-like with a strong claw, which has an accessory claw laterally; except on the two basal segments the hairs on the palps all appear to be simple and not ciliated. Dorsal body hairs long and thin and finely ciliated, in about 10 rows of 6–8 in each. Legs long and thin, front tarsus much shorter than metatarsus, elliptical, all setae long and simple, not ciliated; tarsal claws 3, hind one long and thin, not pulivilliform. Length of animal 760 μ, of dorsal scutum 120 μ by 93 μ high, of sensory hairs 50 μ, of scutal ciliated hairs 40 μ, of dorsal

body hairs 33 μ, front legs 370 μ, tarsus 53 μ by 26 μ, metatarsus 70 μ, middle legs 60 μ, hind legs 68 μ. All coxae with a single hair.

Habitat: Chittering, West Australia, October 16, 1931, under stones (H.W.).

Type: In the South Australian Museum.

HAUPTMANNIA MULLEWAENSIS sp. nov.

Description: Dorsal scutum somewhat heart-shaped with a distinct waist antero-medially, with two pairs of pointed, ciliated hairs and two pairs of sensory hairs, all of which are placed in front of the waist. Eyes one on each side. Palpi as figured, without ciliated hairs, claw strong with lateral accessory claw. Dorsal body hairs long, curved, and ciliated, in 6–8 rows of 6–8 each, on venter

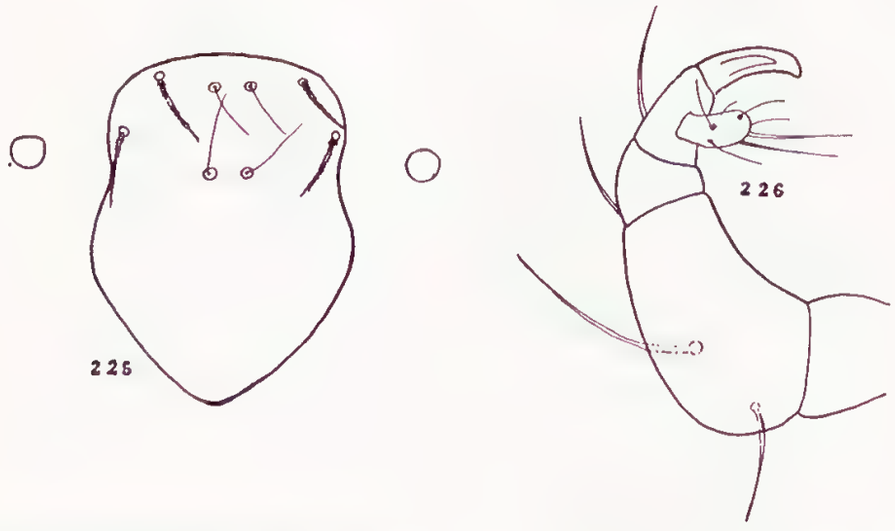

Fig. 225–226. *Hauptmannia mullewaensis* n.sp.: 225, dorsal scutum and eyes; 226, palp.

longer, finer, and not ciliated. Legs long and thin, front tarsus parallel-sided, truncate apically, shorter than metatarsus, with long, thin, simple setae, claws 3, the hind claw long and thin, not pulvilliform. Length of animal 1,000 μ, width 500 μ, dorsal scutum 235 μ long by 185 μ wide, sensory hairs 52 μ long, ciliated hairs 48 μ, dorsal body hairs 40 μ, ventral hairs 48 μ. Front legs 600 μ long, tarsus 93 μ long by 24 μ high, metatarsus 130 μ, middle legs 420 μ long, hind legs 470 μ. All coxae with a single hair.

Habitat: Mullewa, West Australia, in September, 1931, on herbage (H.W.).

Type: In the South Australian Museum.

Genus BELAUSTIUM v. Heyden, 1826.

Dorsal scutum oblong, narrow, with crista. One eye on each side. Claw of mandible strong and curved. Galea dorsally without hairs. Claw of palp with small ventral tooth. All coxae approximating. Three claws on each foot, the

middle one longer and thinner than the others; in addition there is a pulvilliform hair.

BELAUSTIUM CRISTATUM sp. nov.

Description: Length of body 420 μ, width 250 μ. Colour in life red. Dorsal scutum indistinct but elongate and narrowed slightly in the middle, 42 μ wide anteriorly and posteriorly. Crista distinct, with anterior and posterior pairs of

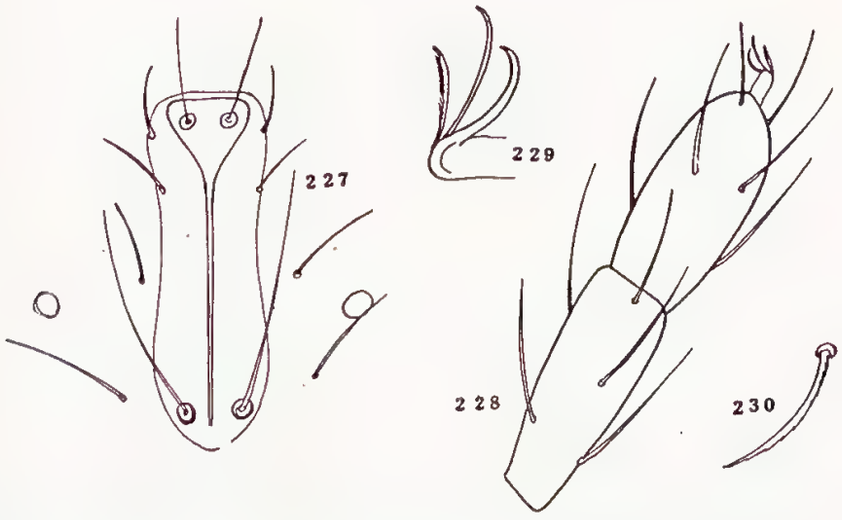

Fig. 227–230. *Belaustium cristatum* n.sp.: 227, dorsal scutum, crista, and eyes; 228, front tarsus and metatarsus; 229, claws; 230, dorsal seta.

sensory hairs, the anterior pair within a triangular area. Eyes one on each side and slightly behind the middle of the scutum. Palpi normal for the genus. Legs short, I 280 μ long, II 240 μ, III 280 μ, front tarsus 58 μ long by 21 μ high, elliptical, metatarsus 30 μ long. Body hairs fine and pointed, indistinctly ciliated on one side, 28 μ long. Claws of tarsi 3, the inner ? one shorter and stouter, the outer ? one pulvilliform.

Habitat: In large numbers on Salvation Jane (*Echium plantagineum* L.) at Glen Osmond, South Australia, September 1, 1933 (H.W.). Most examples were free, but many were attached to larval Jassids and other insects.

Syntypes: In the South Australian Museum.

BOCKARTIA Oudemans, 1910.

Dorsal shield broader than long, without crista. Claw of palp without ventral tooth, with small dorsal tooth. Scutum with two pairs of sensory hairs and 4 thickly ciliated hairs. Eyes two on each side. Mandible with strongly curved claw. Galea with one pair of dorsal hairs. Coxae I and II separated, all coxae with 1 hair. Tarsi with 3 claws, the lateral ones pulvilliform.

BOCKARTIA ? LONGIPES sp. nov.

Description: Length 350 μ, oval. Colour in life red. Dorsal scutum generally much broader than long, but in the specimen figured much less so, almost quite round, no angles, length 112 μ, width 150 μ, with the usual two pairs of sensory hairs, which are 65–70 μ long and finely ciliated. Dorsal scutum with

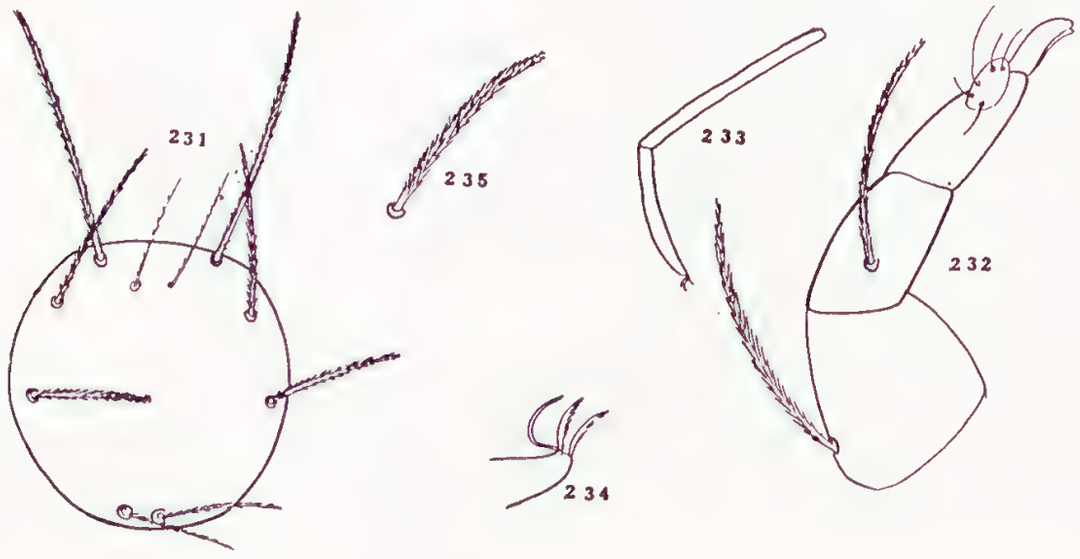

Fig. 231–235. *Bockartia longipes* n.sp.: 231, dorsal scutum; 232, palp, 233, front tarsus and metatarsus; 234, claws; 235, dorsal seta.

three pairs of densely ciliated hairs, one pair on anterior edge 88 μ long, another 80 μ long just posterior of the anterior sensory hairs, and a third pair 80 μ long just posterior of the medial line. Dorsal body hairs rather numerous, 80 μ long, stout, and strongly ciliated. Legs very long, I 960 μ, II 880 μ, III 1,150 μ. front tarsus 162 μ long, metatarsus 285 μ. Tarsi with three claws, the middle one long and thin and simple, the lateral ones pulvilliform. Eyes two on each side. Palpi as figured by Oudemans for *B. kuyperi.*

Habitat: Along with the preceding species at Glen Osmond, South Australia, September 1, 1933.

Syntypes: In the South Australian Museum.

Remarks: This species, although referred to Oudemans' genus, does not agree in that it has three pairs of ciliated hairs on the dorsal scutum instead of two pairs, as defined above. It also lacks the sinus on the posterior edge of the scutum.

KEY TO THE AUSTRALIAN LARVAL FORMS OF ERYTHRAEIDAE.

1. Dorsal scutum long and narrow with distinct crista. One eye on each side. Three tarsal claws, middle one long and thin, outer one pulvilliform.
Belaustium cristatum sp. nov.

Dorsal scutum broader than or as broad as long. Without crista .. 2.

2. Dorsal scutum broader than long, with 4–6 ciliated hairs. Eyes two on each side. Both lateral tarsal claws pulvilliform. *Bockartia longipes* sp. nov.

Dorsal scutum broader than long, with 2–10 ciliated hairs. One eye on each side .. .. 3.

3. Dorsal scutum more or less pentagonal to round, with 4–10 ciliated hairs 4.
Genus *Erythraeus* Latreille.

Dorsal scutum triangular or otherwise shaped, with 2–4 ciliated hairs .. 6.

4. Scutum with depressed sinuate anterior margin, with 6 equally spaced ciliated hairs .. .. *Erythraeus perthense* sp. nov.

Dorsal scutum almost round, with rounder anterior angles and convex anterior margin, with 6 ciliated hairs .. .. 5.

5. Dorsal scutum broader than long, hairs heavily ciliated. Body hairs more numerous. Scutal hairs evenly spaced .. *Erythraeus buforanius* sp. nov.

Dorsal scutum longer than broad, hairs not so heavily ciliated, evenly spaced. Body hairs sparser .. .. .. *Erythraeus dasypodiae* sp. nov.

6. Scutum triangular. Palpi not forceps-like. Hind claw of tarsus pulvilliform 7
Genus *Leptus* Latreille.

Scutum otherwise. Palpi forceps-like. Hind claws of tarsus simple and others pulvilliform .. .. 8.
Genus *Hauptmannia* Oudemans.

7. Crista indistinctly indicated. Front tarsus long and thin.
Leptus bathypogonus sp. nov.

Crista quite absent. Front tarsus short and elliptical.
Leptus chelonethus sp. nov.

8. Scutum rectangular, posterior sensory hairs behind the middle. Front tarsus short and elliptical .. .. *Hauptmannia westraliense* sp. nov.

Scutum pointed apically and with a distinct waist. Anterior tarsi longer, parallel-sided .. .. .. *Hauptmannia mullewaense* sp. nov.

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NATIONAL MUSEUM VICTORIA

ALEXANDER MATHESON MORGAN, M.B., B.S.
February, 1867—October, 1934.

OBITUARY AND BIBLIOGRAPHY OF DR. A. M. MORGAN

By HERBERT M. HALE and JOHN SUTTON.

Dr. A. M. Morgan, Honorary Ornithologist at this Museum, died on October 18, 1934, after an illness of nearly two years. By his passing we have lost an ornithologist of over 40 years' standing, and one of our most able honorary curators.

Dr. Morgan was a South Australian, having been born near Adelaide on February 11, 1867. He took his degrees at the Adelaide University in 1890, and apparently even at that period he had commenced his avian studies. He was not content to investigate only the external features of his birds, but was keenly concerned with their anatomical and osteological structure. Furthermore, he familiarized himself not only with the Australian birds, but many exotic groups.

Dr. Morgan accepted the position of Hon. Ornithologist here in 1922, and at once commenced to arrange systematically our large collection of birds. Later, with the assistance of the present Hon. Ornithologist, he prepared an up-to-date catalogue. Our osteological material was very meagre in this section before Dr. Morgan's appointment, but he took every opportunity of adding to it, and in 1927 presented his own collection of 700 sterna, crania, and other bones. In 1934 this generous gift was followed by another—the donation of a cabinet of 600 sets of eggs, all with accurate data, to which, later, he added 193 clutches. Apart from this he gave to the Board of Governors about 500 bird skins.

The reorganization and building-up of our avian material—both Australian and exotic—was made possible only by Dr. Morgan's special knowledge. It is scarcely necessary to stress the fact that it was an achievement entailing a great deal of work, and the whole-hearted manner in which it was conducted is a tribute to his systematic methods. Particularly, one remembers that he became honorary curator of these collections with a view to carrying out research on the material, but seeing the need for improvement, he decided to put all in order first; as it happened, the result was that he had no time left for the studies to which he had looked forward.

Dr. Morgan took an active part in all movements which fostered the scientific study of birds. He was, for instance, one of the five foundation members of the South Australian Ornithological Association, the first President, and President during five subsequent sessions. He became a member of the Royal Australasian Ornithologists' Union in 1901, and was elected a Corresponding Fellow of the American Ornithologists' Union in 1929.

Although his main interests in science were centred on birds, Dr. Morgan was interested in Australasian anthropology, and collected a series of 147 weapons and stone implements which he eventually presented to this Museum. He was a foundation member of the Anthropological Society of South Australia.

His general regard for Australia and the protection of its fauna and flora is evidenced by the fact that he was a Fellow of the Royal Geographical Society of South Australia, a member of the Fauna and Flora Board of South Australia, and a delegate to the now defunct South Australian Advisory Committee on the Export of Fauna.

Dr. Morgan's published works are listed below. As mentioned above, he had hoped to add a great deal to these during the last 10 years or so of his life, after he had partially retired from medical practice.

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The LEGEND of WAIJUNGARI, JARALDE TRIBE, LAKE ALEXANDRINA, SOUTH AUSTRALIA, and the PHONETIC SYSTEM EMPLOYED IN ITS TRANSCRIPTION

By NORMAN B. TINDALE, B.Sc.

INTRODUCTION.

During the past five years systematic attempts have been made to gather information relating to the natives of Southern South Australia. The work has been carried out during such brief opportunities as have occurred in the course of official duties, from funds provided by the Board of Governors of the S.A. Museum. The urgency of the task may be realized when it is considered that there are now fewer than 30 full-blooded aborigines living in the whole of the area of South Australia east and south of Port Augusta, and it is essential that any information required should be gathered as quickly as possible.

In 1930-31 a small Language Committee was formed at the University of Adelaide, consisting of Prof. J. A. FitzHerbert, Dr. C. Chewings, and the present writer; after much consideration, a working list of phonetic symbols applicable to the general study of Central Australian languages was compiled. The value of this system in the writing of native words in several dialects has been sufficient to warrant its more general use, and in the last few years numerous texts have been transcribed in the languages of the Tangane, Jaralde, Ramindjeri, Buandik, Potaruwutj, and allied tribes of southern South Australia. These will be published as opportunities permit. I am indebted to Prof. FitzHerbert for his advice in the preparation of this text for publication, particularly with regard to the selection of the phonetic symbols.

The accompanying sketch map shows a small portion of Narrung Peninsula on the eastern shore of Lake Alexandrina (Long. 139° 10′ E.; Lat. 35° 30′ S.) to illustrate the approximate track of Waijungari in his flight with his two stolen women. The native place names include a few of 1,200 newly-recorded for the coastal districts of this portion of the State.

THE PHONETIC SYSTEM.

The alphabet of the International Phonetic Association was chosen as a basis, owing to its widespread and increasing use in papers dealing with phonetics as well as in books of elementary instruction in European languages. The phonetic values of the vowel symbols are defined below. Two considerations have weighed in their choice; (a) the availability of type and consequent ease of printing in South Australia, and (b) the desirability of preserving legibility for general

workers, who may desire to obtain a readable account, without concerning themselves with the finer shades of pronunciation. Where native legends are published in Journals which must have a general appeal, this aspect is of special importance.

Many systems have been proposed for the transcription of South Australian languages. Teichelmann and Schürmann (1) gave an early account, and while

(1) Teichelmann, C. G. and Schürmann, C. W., Outlines of a grammar vocabulary, and phraseology of the aboriginal language of South Australia, spoken by the natives in and for some distance around Adelaide. Adelaide, 1840.

their system did not distinguish between either [ng], [**ng**], and [*ŋg*], [*θ*], [*ð*], and [th], or [r] and [*r*], it was far in advance of that employed by some recorders of vocabularies, who, up to comparatively recent years, tended to use hybrid methods based on fancied resemblances to familiar English words. We may take as an illustration the following: ['papultawi] rendered as "bubble-dowie" by one who had the word "bubble" in mind, and as "bub-bull-derby" by another whose mind by chance lingered more on words of zoological import. The rapid disappearance of the natives and, in many cases, the impossibility of re-checking the records of such material prevents us from ignoring the work. Schmidt, (2) in his writings, attempted to interpret and correct many of these errors. C. Strehlow (3) used a phonetic system, upon which Gatti (4) partly based the "Reuther-Strehlow System" which he used in writing his Dieri grammar. This system, in practice, shows little advance on that of Teichelmann and Schürmann.

Black (5, 6) in 1916 and 1920 published a series of short vocabularies, in which he applied the International Phonetic Association's phonetic system to South Australian Languages. The principal difficulty encountered by the Committee in attempting to make use of his proposed vowel system is that of general legibility. The importance of this has been stressed in an earlier paragraph. In other respects the suggestions of Black have been freely accepted. T. G. H. Strehlow has in preparation a detailed study of the phonetics of the Aranda language, which will assist materially in classifying our knowledge of the subject.

The sign [ː] has been employed to denote a vowel or consonant is lengthened, e.g. [keiniː l, tuː l, japː urumi]. Stressed syllables are preceded by an accent, e.g. ['keini, 'loldu'wal].

The palatal nasal consonant has been recorded for Australian tribes, and it doubtless exists. Nevertheless, many of those responsible for placing native place names on our maps, and some authors of vocabularies have habitually written gn when they have heard the velar-nasal [*ŋg*], which is by far the more common.

The following list embraces all the sounds found to be required for the transcription of Jaralde texts:

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(2) Schmidt, P. W., Die Gliederung der Australischen Sprachen. Wien, 1919.

(3) Strehlow, C., Die Aranda-und Loritja-stämme in Zentral-Australien. Frankfurt am Main, 1907-1915.

(4) Gatti, G., La lingua Dieri. Rome, 1930.

(5) Black, J. M., Trans. Roy. Soc. S. Aust., xli, 1917, p. 1-13.

(6) Black, J. M., Trans. Roy. Soc. S. Aust., xliv, 1920, pp. 76-93.

VOWELS.

[a] father, Mann (Ger.)
[*a*] cat
[a] cut
[e] there
[*e*] allez (Fr.), almost they
[e] earth, nurse
[i] it, machine
[o] comme (Fr.), almost not
[*o*] obey, almost oak
[u] full, food
[w]
[j] you, yacht
[ai] light
[au] Haus (Ger.), almost house
[ei] they
[oi] boy

CONSONANTS.

[p]
[b]
[t]
[d]
[th] at home
[θ] theatre
[ð] this
[k]
[g]
[l]
[r] trilled or rolled r
[*r*] spirant (red, as commonly pronounced in Southern English)
[m]
[n]
[ŋ, *ng*] king (7)
[ng] green god
[ŋg, ng] finger
[:] indicates lengthened vowel or consonant

Letters and single words written in the phonetic script are placed within square brackets when they appear in the ordinary text.

The range of pronunciation of certain words, even within the limits of a single tribe may be very marked. During many Anthropological Field Expeditions of the Adelaide University and Museum the obtaining of details for sociological data cards has presented opportunities for writing down phonetically, from the lips of many different individuals, words such as the tribal name. As an example we may note that the range of variation of the tribal name Pitjandjara, from recordings in the Mann Range and at Ernabella in 1933, is as follows:

	Mann Range.	%	Eastern Musgrave Range.	%
['Pitjan'djara	70	87·5	41	59
'Pitjandja'djara	8	10	10	14
'Pitjindja'tjara	1	1·2	4	6
'Pitjin'djara	1	1·2	13	18
'Pitjin'jara]	0	0	2	3

The table indicates that the degree of variation of the pronunciation may differ from place to place and that, while the Pitjandjara who were encountered

(7) Lack of a set of the ŋ sign has necessitated the use of the alternative form *ng* to denote this sound in the body of the text.

in the Mann Range were more than 87% consistent in the use of the form ['Pitjan'djara], the eastern members of their tribe who are in closer contact with the Jankundjara tribe were only 59% consistent in the use of this term.

The securing of a standard pronunciation which would exactly reflect that of the majority of the persons of a tribe would thus appear to be a considerable undertaking, and it is to be noticed that in many cases individuals vary their own pronunciation.

In some words the consonants [p] and [b], [k] and [g], [t] and [d] do not appear to the native ear to be significantly different, and may be used indifferently, although in other tribes they may either tend more towards the one than to the other, or are particular to clearly stress the difference (in some words, if not in others). Recorders tend to respond differently to this situation so that in practice two schools seem to have arisen, firstly those who tend always to write such words with [b] [g] and [d], and secondly those who use [p] [k] and [t]. Teichelmann and Schürmann, C. Strehlow, Reuther, and many recent workers have followed the latter practice. The matter should be systematized, for the sake of the general reader, otherwise we will continue to get such needless variations as [tjukur] and [djugur].

In preparing vocabularies it has been found convenient to record both, if they occur, and to combine all words commencing with [b], [g], and [d] with the letters [p], [k], and [t] respectively, e.g. [kata, gada; gawi, kawi] would all appear in the vocabulary under [k]. In general writings the [kata] and [kawi] forms would be given preference, because, while in some native dialects [b], [g], and [d] are practically non-existent, [p], [k], and [t] are always present.

HISTORICAL INTRODUCTION.

The first account of the legend presented in this paper is that told by the Ramindjeri people of Encounter Bay, and detailed in English by Meyer (8). In this story "Waijungngari" is the son of "Ningarope", and was made by his mother. She fashioned him from red-tinged excrement which she moulded into the form of a man, who showed signs of life, and laughed. He was "kainjani" because of his red colour. His brother "Pungane" had two wives, and lived near the sea. When "Pungane" was absent, his wives found his brother, woke him from sleep by pretending to be emus, and embraced him. Waijungari's mother was enraged, and went to Pungane, who, in vexation, placed fire upon the hut while the three were absent, saying *"kundajan"*, meaning: "let it remain but

(8) Meyer, H. A. E., Manners and Customs of the aborigines of the Encounter Bay tribe. South Australia, 1846, p. 12.

not burn immediately''. The sleepers awoke, and throwing away their kangaroo skins escaped to the sea, where Waijungari threw into the sky first a plain spear which fell down again, and then a barbed one, which remained fast in the sky. He climbed up, and the two women went after him. Pungane and his mother followed, and they all remained in the sky.

The second account of the legend is a brief one given by Wyatt, (9) in the language of the people of the Kaurna or Adelaide tribe, to whom Waijungari was known as ''Monana''. It is short, and may be transcribed in full:

Monana	aratje	kaia	pemane,	ea	pemane,	ea	pemane,	pura
Monana	many	spear	threw	here	threw	here	threw	bye-and-bye

kaia	kur : a	pemane,	kaia	kur : a	jewane,	kotin : e	kaia	
spear	upwards	threw	spear	upwards	stuck-fast	again	spear	

jewane,	pura	jerta	jewane;	Monana	kaia
stuck-fast	bye-and-bye	in-ground	stuck-fast..	Monana	spears

tate : ne	kur : a	wine : n.
climbing	upwards	went.

The third account of this story is that briefly told in English by Taplin (10) in his account of the so-called ''Narrinyeri'' complex of tribes. This is the version of the Jaralde tribe, and in the main it seems to be a paraphrase of the legend recorded by Meyer. According to Taplin, ''Wyungare'' lived at ''Rauwoke'', and went down to ''Oulawar'' where he drank water through a reed. He ran away with ''Nepelle's'' wives and hid in the mud at ''Lowanyeri''. Using first a barbless and then a barbed spear with a line attached, he climbed into the heavens. He still sits there and fishes for men with a fishing spear. When people start in their sleep it is thought to be because Waijungari has touched them with the point of his weapon.

The story here given was related first in English and then taken down directly in Jaralde phonetic script from the dictation of Frank ''Blackmoor'', and a word-for-word translation made. ''Blackmoor'' is an aged full-blooded aborigine of Peltangk (Section 929, Hundred of Malcolm). He belongs to the Peltindjeri clan (an offshoot of the Rangurindjeri clan) of the Jaralde Tribe. In his anxiety to have an accurate transcription he repeated his story the same evening to a younger educated native, and subsequently produced for inspection a manuscript which served as the basis for a second more detailed phonetic transcription. As Blackmoor's own Jaralde manuscript is the only example of its kind that we have had the opportunity of examining, it has been printed without alteration,

(9) Wyatt, W., Some account of the manners and superstitions of the Adelaide and Encounter Bay aboriginal tribes. Adelaide, 1879.

(10) Taplin, G., in Woods, J. D., Native Tribes of South Australia. 1879, p. 56.

and placed after the main published phonetic version. Where the text departs from the principal version it is at fault, the error having been left unaltered in his manuscript.

A spoken version of the Waijungari legend has also been recorded on two Edison wax cylinders (in the custody of the Board for Anthropological Research at the University of Adelaide), and it is hoped that it may eventually be reproduced in a more permanent form.

'WAIJU'*NG*ARI

'Nep:ele[11] nei 'waratj 'leweimb *'ng*ulawar. K*eng*in mimane*ng*
Nepele sat on-Ngawuluwaru. His women-two

'lewin kar 'junth. 'Wanje*ng* *ng*op:u*ng* lolthu
sat together. Then-they-two desired-to-walk down-there

'Wangara'war.[12] 'Luk:ei*ng* a lolthu *ng*op:u*ng* 'logoralt.
to-Wangarawar. Thus-the-two down-there walked fresh-water-mussel-

Kitj walth 'leweimb 'Pulaweiwalth[13] 'Waiju*ng*ari
gathering. There sat at-Parlowewangk Waijungari initiate-

na'rambi a korn.[14] 'Wanjitj lolthu *ng*op:u*ng* 'Wangara'war.
wearing-red-ochre man. Then down he-walked to-Wangarawar.

'Wanjil 'mut:u*ng* itja*r*n 'pere*ng*oke ina*ng* 'prankan*g*ai. 'Wanjitj
He drank his water with reed-stem. Then

'kuru'*ng*urun itj pe're*ng*oke. 'Lamba'larn ne*ng*uli'orn nak:u*ng* itja*r*n
reddish-became water. It-happened they-two saw

pe're*ng*oke 'kuru*ng*u 'leimbitj. Wanje*ng* lak ja*n*:ang,
water reddish had-become. Then-they-two thus said,

"'Mura'*ng*alamb itja*r*n pe're*ng*oke 'netj lak 'jumun." E:! wanje*ng*
"For-what-reason water thus appears." Ah! then

'lorowal 'nak:i:l itja*r*n na'rambi korn. Lambulan neng
above they-two-perceived red-ochre man. It-happened these-two

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(11) [Nep:ele]—(sometimes better rendered as [Nep:ile]). An ancestral man of the Jaralde tribe who lived at Ngawuluwaru (north-east corner of Section 468, Hundred of Baker). Ngawuluwaru is also called Ngulawar in the manuscript. Nep:ele was the elder brother of Waijungari, and possessed two wives; among the Ramindjeri people he was known as [Pungane] (Meyer gives three different spellings: Pungungane, Pungngane, Pangngne).

(12) [Wangarawar]—the northern point of Section 469, Hundred of Baker. Nep:ele forbade his wives to go northward along the shores of Lake Alexandrina towards Wangarawar.

(13) [Parlowewa*ng*k]—Section 469, Hundred of Baker.

(14) [na'rambi a korn]—Waijungari was a youth undergoing a stage of initiation; he was decorated with red-ochre and emu oil. During this period he was a ['kaindjani], and was [na'rambi], a word which may be translated as "sacred". A [kaindjani] must not be seen by women; hence the anxiety of Nep:ele that his wives should not go to Wangarawar. Meyer gives three different spellings for the name [Waiju*ng*ari], namely Waijungari, Waijungare, and Waijungngari.

tal : i : l. "A : ! korni *ang*alanji." Wanjitj *ng*op : eil 'loldu'wal
desired. "Ah! man belonging-to-us." Then he-walked down-to

'*ng*awanth*ang*.(15) 'Wan'je**ng**ulearn 'wareing. 'Wanje**ng**ulearn 'nak : eimb.
his-camp. The-two-of-them followed. The-two watched.

"A : ! netj 'jap : uleil '*ng*awand*ang*." 'Wanje**ng**au '*ng*op : i : l 'lorowal
"Ah! he has-entered camp." Then-the-two walked up-towards

'*ng*awand*ang*. 'Wan'je**ng**ulearn 'nak : *ing* 'itj*a*rn 'jap : u'rumi. 'Wanjil
camp. The-two-of-them saw the-entrance. Then

'en*a***ng**i : l 'pra : til, "'U : and 'tangul*a*rni 'mar! 'wanj*a*rn
remarked elder-sister, "Over-there stand younger-sister! then

tu'rort arn lok : arar(16) 'naraju 'waiju'ka 'inan'djera 'kon'g*a*rneimal."
throw-down your mussels noiselessly otherwise hear-he-may."

"*Ng*ap 'aldj*a*rn 'tangulan." 'Wanj*ang*al lak 'kaikul*ang* 'elina 'peindjal*ang*.
"I here will-stand." Then-the-two thus called-out like emus-two.

'Wanje*ng* 'kaikul*ang* wanjitj tur**lang**. "A : 'marmean!" Wanjil
Then-they-two called he mistook-it. "Ah food-for-me!" Then-he

morok : *o*ng 'itj*a*rn 'kaik : e. 'Wanjitjau 'tarup : ulung 'mara**ng**u'aijuka
seized his spear. Then-he started-to-come-out very-softly

'mel : ung 'tarupu'lelitja 'wan'je**ng**ulearn 'pu'l*o*rndu*ng*. 'Wanjil 'en*ang* il
when he-came-out the-two-of-them gripped-him. Then said

'pra : til "A : 'korne '*ang*alan. 'Mo'rok : *o***ng** '*ng*al**ang**earn
elder-sister, "Ah : Man belonging-to-us. Hold-him for-us

ma'nendju'aijuka." Wanjitj mu'noinp : arlang itj korni 'Waiju'*ng*ari.
tightly-very." Then-he weakened the man Waijungari.

'Wanjarau 'jap : uli : l junth en '*ng*awandalth. 'Itjau jap : ulelitj
Then-they-all entered together the camp. He entered (set)

'nangi. 'Lambulan 'nar 'tanteil. 'Wanjar 'tup : ung *a*rn*ang*
sun. It-happened they slept. They covered with

'wankarnda'*ng*ar. Wanjitj 'wilkeilitj 'Nep : ele. "'Jan*ga*nei*ng*
kangaroo-skin-rugs. Then-he looked-about Nepele. "Where

'nap : ei*ng*?" Wanjitj loldu '*ng*op : u*ng* 'Pula'weiwalth *ng*a'leim*ang*
wives-two?" Then-he down walked to-Parlowewangk guessing

elila Wanjil*a*rn 'nak : **ang** 'tanteimbar. Wanjitj pul**tung** in
he-did. Then-he-them saw asleep-they-were. Then-he reached for

'keinalt. Wanjil tu'runthu*ng* a : n wa'lak : aijar. Wanjil*a*rn jup : ung
fire. Then-he plucked some grass. Then-he some

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(15) [*Ng*awanth*ang*]—The [*ng*awandi] or hut, made of logs and brushwood, belonging to Waijungari was situated at Parlowewangk, a little inland from the watering place among the reeds at Wangarawar.

(16) [lok : arar]—The lok : ori or fresh water mussel is *Unio ambiguus*.

'orau 'ngawandan 'aruk 'tantai. Wanjiliarn 'janimindung itjarn
placed-over camp where they-slept. Then-he talked to-the

keini luk:i, "Ung 'kongonein'darn ngo'ronkul wan tam."
fire like-this, "When hear-you-them snoring then-burst-(into-flame)."

'Mel:ung ngo'ronkoleilar wanjitj 'tam:ang. Wanjitj ju'rankeil itj ngawandi.
So-when snore-they-did then-it burst. Then-it burnt camp.

'Wanjar tertang. Aruk 'tu:lemb ar 'wangkarndar. 'Lorowar 'kalthei:l
Then-they sprang-up. They carried skins. Up-to-wards they-ran

Tjenbartang.[17] Itjuk peinkung jam wankarndi.[18] Il 'arnuk
Tjenbartang. There fell one skin. He-them still

pe'reilti:l 'keini:l 'itjarndu pe'rengoke tarupuleimb ru:wunend.
chased fire its water came-out of-ground.

'Arukar pimingemb ar 'wankarndar. Il arnuk 'ware'ambil 'keini:l.
They-fell one-by-one the-skins. He them still-followed the-fire.

'Wanjarau tarupulung[19] 'Malbin'djerang.[20] Nar tarukundeilin
Then-they came-out at-Malbindjerang. They dived-into

maneinga ð Kitj 'awitj 'keini mu'nanai'kulun. 'Aruk 'mondeil
mud. He still the-fire raged-around. They stooping

tu:l.[21] Wanjilearn 'mimini lak 'enangi, "'Nak:a'lur
sat (up-to-the-teeth). Then-he women thus said-to, "See-now

jangitj 'keini." Wanjil lak wu'rinthang, "Netj 'aldjalun itj keini."
where-is fire." Then thus answered, "He still-here the fire."

Wanjar 'moruwen 'tal:ang mu'lawai pi:. 'Wanjitj 'parnang
Therefore stooped they yet a-little-time. Then-it dead

itj 'keini. Wanjar 'marnd tarupuli:l. 'Wanjarau 'ngop:eil
became fire. Then-they from-under came-out. Then-they walked

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(17) [Tjenbartang]—Section K, Hundred of Baker. One of the highest points on Narrung Peninsula; it is a low, partly consolidated sand-dune covered with yacca tree scrub.

(18) [wankarndi]—skin of kangaroo. Kangaroo skins were used as rugs and cloaks. The native method of preparing the skins consisted of pegging them out on the ground, fur side down, and covering them with ashes. They were afterwards laid over a stick and scraped. The moisture exuding from the skin was likened to shallow water on a flat salt lagoon, hence in this story of the heroic age, the skins, as they fell, became salt lagoons which impeded the progress of the raging fire before which the three fugitives were escaping; the country between Kalpang (Section 258) and Malbindjerang (Section 498) is to-day covered with these lagoons.

(19) [tarupulung]—Came out of the thick yacca and ti-tree scrub on to the shore of Lake Albert. This word has the same root as the word ['tarupango] used by Pitjandjara men in the north-west of South Australia to indicate the passing of the ancestral being into the ground.

(20) ['Malbin'djerang]—north end of Section 498, Hundred of Baker. A point running out to the east; it is a place noted among the aborigines for its thick, soft mud deposits, into which one sinks deeply; the name itself means "muddy place".

(21) [tu:l]—teeth. The phrase means, literally, "Up to the teeth in muddy water". This corresponds to our slang phrase "up to the eyes".

nan : aweil itjarn 'ru : we[22] 'jaroalangarn. 'Wanji'lau nak : ung itjarn
examined the ground way-to-go. Then-he saw the

'waieri il 'Waiju'ngaril. 'Wanjil 'enang, "Lorowal a'ngani."
sky did Waijungari. He said, "Up-there we-will-go."

Wanjilearn 'jam 'kaik : e jangkundur.[23] Wanjilearn lak : ang itjarn
He one spear untied. Then-he speared the

'waieri. Wanjitj 'keilangeil. Wanjil 'kitjanu 'kaik 'jangkundur.
sky. It came-back-again. He another spear untied.

Wanjil 'kitjanu 'kaik lak : ang 'loru waieruwar. A : 'tanpuleilitj
He another spear threw-up towards sky. Ah! held-it-did

'kaik : e. 'Lambulanak netj 'pingkeilitj 'waieri. Wanjitj 'pultung in
spear. Soon it fell the-sky. Then-he reached for

'kaik : alð. Wanjitj 'jap : ulung in wairalt. Wanjil 'nan : awung itjarn
his-spear. Then-he climbed for the-sky. Then-he looked-about the

'ru : we. "Kitjatj ngangkuri ru : . 'Jap : ulal
ground (of the sky). "This-is good ground. Climb-you-two

'luwuru'ngul. Wanjeng 'jap : ulung." Nar'waral 'lewinal 'waieru'war.
also. Then-they climbed." They-up-there sit in-sky.

'Nangun arn 'nak : un'ela nga'nep : að arar terldar.[24] Netj um
You there may-see three stars. There in

turntangk 'tangulun itj 'Waijungari.
middle standing is Waijungari.

STORY OF THE MAN WAIJUNGARI, WHO BECAME THE PLANET MARS.

Nepele sat (camped on the hilltop) at Ngawuluwaru. His two wives sat beside him. It happened that they both desired to walk down towards Wangarawar (which they had been forbidden to do). While they were gathering fresh-water mussels they noticed that they had arrived there. It happened that there sat (camped) at Parlowewangk a (newly initiated and therefore red ochred) sacred man called Waijungari. Waijungari walked down to Wangarawar also. There he drank water through a reed-stem. The water became reddish (from the ruddle which fell from his body). It happened that the two women noticed that the

(22) ['ru : we]—ground, earth, country. Waijungari and the two run-away wives of Nep : ele feared the anger of Nep : ele, and searched for a means of escape.

(23) ['jankundur]—untied his bundle of spears. He carried a bundle of these weapons; in some versions of the legend, when spearing the sky, he used a string tied to the butt of the shaft to enable him to haul the sky down towards the earth; the first spear, which failed, was unbarbed, the second was made of shea-oak wood, and bore a series of barbs down one side.

(24) [terldar]—star (other renderings are *tuwulda* and *tu : lda*). Only one of the three "stars" has been definitely identified. Waijungari is the bright planet Mars.

water had become red. Then the two women said to each other, "Why has the water become like this?" Above them they then perceived the red-ochre-man (standing on the bank). The two thought him very desirable. "Ah! he is the man we want". Then Waijungari (who had not perceived them) walked back to his camp. Both (of the women) followed. They watched. "Ah! he has entered his hut (camp). Then the two (women) walked nearer to the camp. They saw the entrance. Then said the elder sister, "Stand over there, younger sister, and place your bag of mussels noiselessly down so that he may not hear you. I will stand here". Then the two imitated the noises of emu. He mistook their calls. "Ah! there is food for me". He took up his spear. He commenced to sneak out very quietly; as he emerged the two (women) seized hold of him (by his penis). Then said the elder sister, "This man belongs to us. Hold him firmly". Then the man Waijungari yielded. They all three entered the hut together. The sun set. Bye and bye they slept. They had covered themselves with kangaroo skin rugs. Nepele began to be suspicious (and look about for tracks). "Where are my two wives"? Then, guessing their intention, he walked down to Parlowewangk. He saw that they were all asleep together. Then he seized a fire-stick. He plucked some grass. These he placed over the camp where they slept. He spoke to the fire in this strain: "Burst into flame when you hear them snoring". They snored, and it ignited. It burnt their camp. They fled. They carried with them their kangaroo skins. They ran (at first south-eastwards) towards Tjenbartang. One of the kangaroo skins fell from their grasp. The fire still raged behind them, but the water (from the kangaroo skin) came out on the ground. The kangaroo skins fell one by one as they fled. The fire still raged behind them. They came out (of the scrub) at Malbindjerang. They dived into the mud. The fire raged about them. They stooped down. They cowered up to their teeth (in water and mud). Then he (Waijungari) said to the women, "See where the fire is raging now". Then they answered him, "The fire still burns near us". Therefore they remained cowering for a further space of time. The fire became dead. They came out from under (the water and mud). Then they walked about examining the country and (sought a) way to escape. Then Waijungari looked up towards the sky. He said, "We will go up there". So he untied one of his spears. Then he speared the sky. The spear fell back. He untied another spear. He threw this other one up towards the sky. The spear held fast. Soon the sky fell downwards (towards the earth). He was able to reach up to his spear. He climbed up into the sky. He examined the land in the sky. (He said) "This is good ground. Climb up. You two must climb up also". Then they both climbed. They still remain there in the sky. You may see three stars there now. The central one is Waijungari.

WYOONGURRIE.

(Blackmoor's Non-Phonetic Version.)

Nepilee ney wur-ich lew-amb ngirlawar. Kangin meem-in-ang lewing Kar yoonth. Wun-yang ngoping lol-thoo wung-ur-a-war. Luk-ang a-lolthoo ngoping loger-ulth. Kich wulth lew-amb Pool a wulth Wyoongurrie nrumbee a korn. Wunyich lolthoo ngopung Wungur-a-war. Wun-il moothing ichurn Prang-ookie in-ung Prunk-ung-i. Wun-ich kroong-ool-ring ich prang-ookie. Lumbil-urn nangooliurn nuking ich-urn prang-ookie kroong-il-amb-ich. Wun ang look yurning. Moor-ung-ul-umb ich-urn prang-ookie nech look yoomin. Ee: wun-yang loroo-wul nuk-eel ich urn Nrumbie korn. Lum-bil-urn nang thil-eel ah korn-e-ung-ul-ine. Wun-ich-ngop-eel lol-thoo-ul ngow-un-thung. Wun ang-ool-e-urn wur-reung. Wu-nanyool-eurn nukamb ah nech yupool-eel. Wun-ang-ow-ngop-eel lor-oo-ul ngou-un-thung. Wun-ang-ool-e-urn nuk-ing ich urn yup-ool-oom-ie. Wun-il ening he-l Pra-til. Oo-und thung-ool-urnie ma-r. Wun-um thrort urn lock-er-ur-nri-oo-i-ook-ou in-unjiri koong-urn eem-ul. Ngup-ul-jurn thung-ool-urn. Wun-ung-ul look ki-koorl-ung el-in Peen-jurl-ang. Wun-ang ki-kool-ung wun-ich turlung ah mem-ee-urn. Wun-il mrok-ung ich-urn ki-kee. Wun-ich-how thur-pool-ung mrung-iu-I-ook-urt mel-oong thur-pool ich-uch. Wun-ang-ool-e-urn ploorn-doong, wun-il-enning eel Prart-il. Ah korn-ee-ung-ul-ine. Mrod-ung ngulung-ee-urn mning-joo-I-ook-ah. Wun-ich mrnopurling-ich korney Wyoongurrie. Wun-ur-ow yup-oorl-eel yoonth in ngow-unthulth. Ich-ow yup-ool-el ich nungie. Lum-bil-urn nur turn-teel. Wun-ar-toop-ung urn-ung wurn-kurnding-ur. Wun-ich wilk-eel ich Nep-il-ee. Yung-un-ang Nap-ang. Wun-ich lolthoo ngopung Poolooway-wulth nglam-ing el-il. Wun-il urn nukung turnt-amb-ur. Wun-ich pool-thing in kairn-ulth. Wun-il-urn yoop-ung-or-ou ngow-unthung ur-ook turnti. Wun-il-e-urn yurn-im-in-dung ich-urn kairney look-ee. Oong, koong-urn-eend-urn ngronkool wun-tum. Meloong ngrong-koorl ur r wun-ich tum-ung. Wun-ich yrung-eel ich ngow-unthee. Wun ar tirting. Ur-ook thael-amb ar wurnkurndar. Lor-oo-ur klthe-eel Chin-bur-tong. Ich-ook pinking yum Wurn-kurnd. Eel arn-ook prelthy-eel kairn-ill ich urn-doo preng-ook. Ar-ow nur peeming-amb-ur wurn-kurn-dar. Eel-urn-ook wury amb eel kairn-il. Wun-ar-ow thur-pul-ung Mulbin-jer-ung. Nur thoork-orrndeel in mrnang-ulth. Kich-ow ich kairnee. Ur ook mon-thal. Wun-il-ee-urn meem-inee look en-ung-ee nuk-ul-loor yung-ich kairnee. Wun-il look wrin-thung nech uljul-urn-ich kairnee. Wun-ar mor-oo-un turl-ung mlow-i pe-e. Yun-ich porn-ung ich kairnee. Wun ar marnd thur-pool-eel. Wun ar ow ngopeel nun-ow-el ich-urn roue yur-ow-il-ang-urn. Wun il or ou nukung ich-urn uy-eree eel Wyoong-ur-il. Wun-il-en-ing lor-oo-wul-ung-urn-ee. Wun il-ee-urn yum ki-kee yurn-koorn-door. Wun-il

luking ich urn wy-er-ree. Wun-ich ke-il-ung-aal. Wun il kich urn-oor kike yurn-kurn-door. Wun-il kich-urn-oor kike luk-ing lor-oo wyer-oo-wur. Ah turnpool eal-ich ki-kee. Lumbil-urn-uk nech ping-eel ich wyer-ree. Wun ich pul-thung in ki-kulth. Wun ich yup-ool-ing in wyer-ulth. Wun-il nun ow-ung ich-urn roue. Kich-uch ngunkeri roue. Yup-oorluloor oong-ool. Wun-ang yup-ourl-ung. Nur wur-ul lew-in-el wyera-wur. Nung-oorn-urn nuk-in-el-ee ngap-ul thur thel-thur. Nech oom toornt-ang thung-oorl-oon ich Wyoongurrie.

THE GEOGRAPHICAL SIGNIFICANCE OF THE LEGENDS.

The association of the legends of the Southern Australian tribes with geographical features has not been stressed sufficiently in the earlier accounts of their mythology. There is marked identification with the topography of the country in which they are related. They are in this respect little different from many stories of the wandering of the totem ancestors of the Central Australian peoples such as have been so ably detailed by C. Strehlow ([25]) and others. Their heroes are great men who are only occasionally identified with totemic animals; in this and other respects they differ materially from the Central Australian stories.

The Jaralde legends of Waijungari, like all the stories of this and allied tribes, are intimately linked with physical features, the origin and significance of which they incidentally attempt to explain. For example, the lagoons scattered along the track where the man and two women fled in this story are the kangaroo skins which Waijungari dropped in his haste. The lagoons mark the line of his flight. The particularly muddy southern shore of Lake Albert at Malbindjerang was conjured up as a refuge for him. The tendency of bush fires commencing on the shores of Lake Alexandrina to sweep fiercely through the swampy land with its thick undergrowth, and to rush wildly before the hot north and north-west summer winds towards the corner where Waijungari and his paramours had fled, are determined by the geography of the peninsula. Lifted from this setting they lose a great deal of their significance. When we discuss the great story of Ngurunderi, of which a detailed account is reserved for a later occasion, we learn that the canoes of this ancestor still lie in the position in which he abandoned them. They have been metamorphosed into the Lalangengul, two great fixed sand-hills at Mount Misery, beside the main road at Section 219, Hundred of Malcolm. The shoals upon which the great Murray Cod of the Ngurunderi legend was cut up to form the smaller fishes, still lie in Lake Alexandrina as "proof" of the veracity of the legend. Without continuing the argument too far, it may be re-

([25]) Strehlow, C., Die Aranda-und Loritja-stämme in Zentral-Australien. Frankfurt am Main, 1907-1915.

marked that the legends, when associated with their geographical context, enable us to understand the people in a manner denied to those who know only the anglicized, generalized stories.

It is a matter of particular regret, therefore, that non-localized versions, purporting to be authentic myths and legends of the Australian aboriginals, and introducing such amazing conceptions as chariots of fire and the angels of Semitic mythology, as well as other paraphernalia, should have been published. Such stories are undoubtedly based on authentic legends, but have been so distorted in their new setting that they will become recognizable only when, or if, native texts can be obtained.

The identification of Waijungari with Mars, the red wandering planet of the heavens, has been confirmed from several native sources. The other two "stars" have not been identified. The Government Astronomer (Mr. G. F. Dodwell) has made the suggestion that the story of the two women of the legend may have originated from observations of the planets. He suggests that the two women may be identified with Jupiter and Venus, both of which wander over the heavens and come into conjunction with Mars, travel with it, and are together "overwhelmed" by the fiery orb of the sun, re-appearing after a lapse of time as evening stars. Maegraith ([26]) has shown that the Australian aborigines have a remarkable interest in the movements of the planets and the appearance of the principal constellations, so that there is some probability in this attempted explanation.

SUMMARY.

The legend of Waijungari is set out in the language of the Jaralde Tribe, of the eastern shore of Lake Alexandrina, South Australia, together with an English translation. Details are given of the phonetic system employed in the transcription of this legend and of numbers of as yet unpublished songs and stories relating to the tribes of southern and western South Australia. There is a discussion on the significance of the geographical settings of the legends, and a knowledge of local topographical detail is shown to be of fundamental importance in coming to a detailed understanding of native mythology.

([26]) Maegraith, B. G., Trans. Roy. Soc. S. Aust., lvi, 1932, pp. 19-26.

REVISION OF THE AUSTRALIAN GHOST MOTHS (LEPIDOPTERA HOMONEURA, FAMILY HEPIALIDAE)

PART III.[1]

By NORMAN B. TINDALE, B.Sc., South Australian Museum.

Fig. 1-129.

Elhamma Walker.

Elhamma Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1561.
Perissectis Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1119.
Elhamma Kirby, Syn. Cat. Lep. Het., 1892, p. 887.
Perissectis Pfitzner and Gaede, Seitz Macrolepidoptera, x, 1933, p. 841.

Male with antennae stout, each segment expanded laterally and compressed longitudinally on one side (fig. 1). Labial palpi two-segmented, first as long as wide, densely clothed with slender hairs, second segment three times as long as wide, clothed apically with short, clubbed hairs (fig. 2). Maxillary palpi rudimentary, composed of a single small subspherical segment. Forewings with R_1 anastomosed with R_S for a short distance before and after branching off of R_4, thus forming a small cell. Hindwings, in male, depart greatly from normal Hepialoid form; R_1 fused with R_S to, or beyond forking of R_2 and R_3: only two M veins present. M_1 and M_2 fused (causing obsolescence of M_1), Cu_2 reduced; only one analis vein developed. In the female the venation of the hindwings is unlike that of the male, being practically identical with *Oxycanus* except for the absence of any trace of 2A.

Genotype: *Elhamma inconclusa* Walker, synonym of *Hepialus australasiae* Walker, nominated by Kirby, 1892.

Walker placed five species (*subvaria, inconclusa, signata, determinata,* and *antipoda*) in this genus. On a subsequent page of his "List" he removed one species, *subvaria,* to *Oxycanus.* Butler in 1874 placed *signata* in *Porina.* In

(1) Part I was published in Rec. S. Aust. Museum, iv, 1932, pp. 497-536, Fig. 1–64. Errata in part i are: In Fig. 26 showing venation of *Abantiades hyalinatus* the analis veins are wrongly marked. 1A should read Cu_2, 2A is 1A, and 3A is 2A. Part II *idem* v, 1933, pp. 13-43, Fig. 1–92. Errata in part ii are: p. 16, line 18, read "*rufobrunnea*" not "*rufobrunna*"; page 26, Fig. 36, read "male", not "female"; p. 39, the legends of Fig. 80 and 81 are transposed.

1889 Meyrick placed *determinata* in *Porina* and *inconclusa* in his new genus *Perissectis*, as a synonym of *australasiae* "Donovan". Meyrick did not nominate a genotype for *Elhamma;* Kirby in 1892 selected *inconclusa*. *Perissectis* is thus a direct synonym. The generic description in Seitz is applicable only to the female, the great difference present in the venation of the two sexes has doubtless led to confusion.

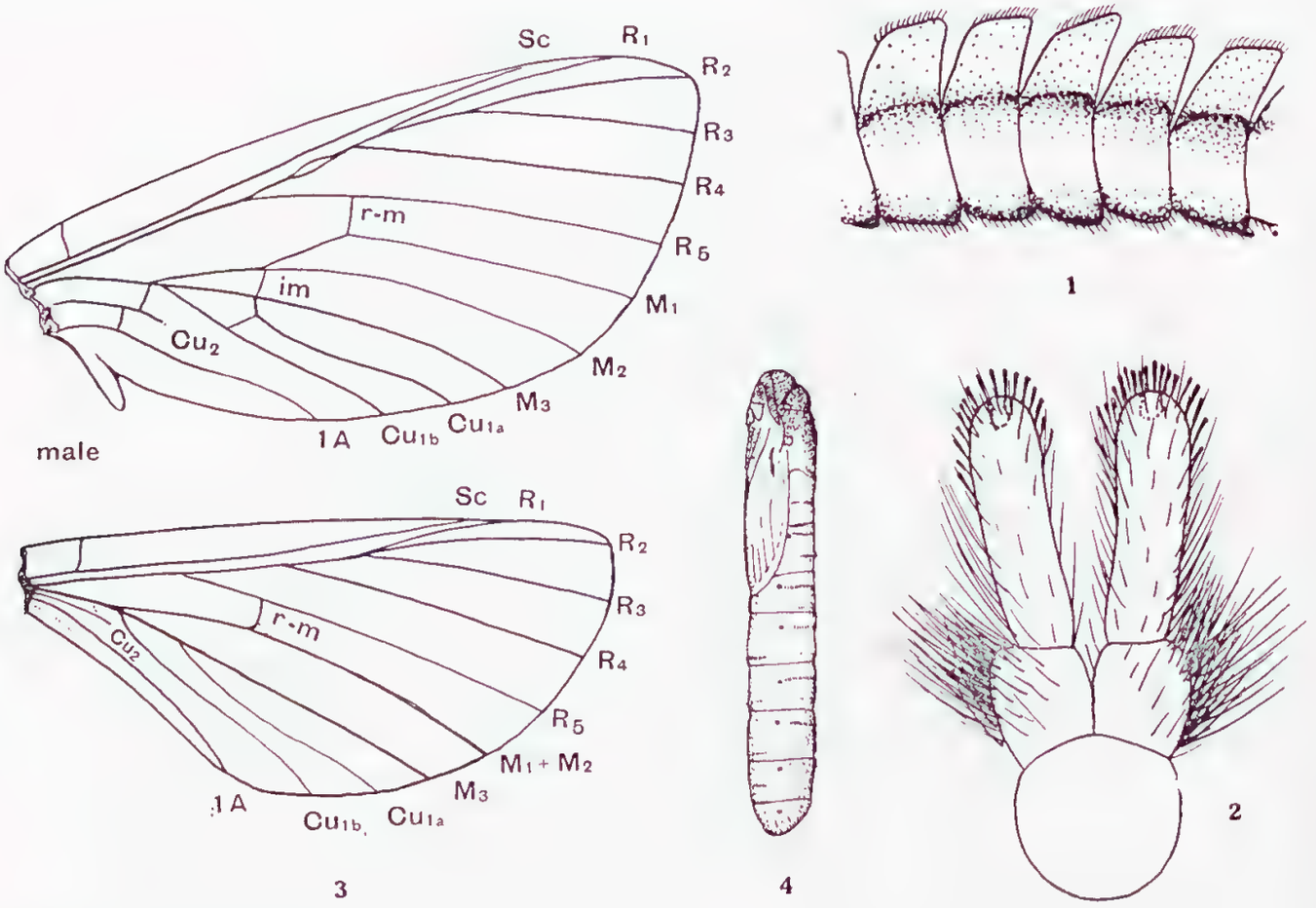

Fig. 1–4. *Elhamma australasiae* (Walker). 1, portion of male antenna; 2, labial palpi; 3, male venation; 4, pupa.

This is an endemic genus, containing only a single species, the distribution of which corresponds closely with the uniform rainfall areas in eastern and southern Australia where the rainfall exceeds fifty inches and the average annual temperature does not exceed 70°.

ELHAMMA AUSTRALASIAE (Walker).

Fig. 1-8.

Hepialus australasiae Walker, List Lep. Ins. Brit. Mus., vii. 1856, p. 1558 (female).

Elhamma inconcluso Walker, *l.c.* p. 1562 (male; in index name is corrected to *inconclusa*).

Perissectis australasiae Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1119.

Perissectis australasiae Pfitzner and Gaede, Seitz Macrolepidoptera x, 1933, p. 841, pl. 76e (female).

Porina banghaasi Pfitzner, Seitz Macrolepidoptera x, 1933, p. 841, pl. 78d (male).

♂ Head, antennae, and thorax brown, abdomen salmon-pink, at apex purplish-brown. Forewings brown with an angled diffused darker band from below

Fig. 5–8. *Elhamma australasiae* (Walker). 5, male, Sydney (type of *inconclusa* Walker, in British Museum Collection); 6, female, National Park, Sydney; 7, male, Moe; 8, female, Moe.

apex to M_1 near base, thence to base; a silvery-white streak follows r-m and extends to M_2, numerous darker scattered flecks, specially abundant near margins; hindwings salmon-pink. Expanse 42 mm.

♀ Head, antennae, and thorax brown, base of abdomen salmon-pink, otherwise purplish-brown. Forewings unicolorous brown with scattered minute flecks of dark brown; hindwings salmon-pink. Expanse 70 mm.

Loc. Queensland: National Park (3,000 ft.) 2, 3(2). New South Wales:

(2) Numbers after the locality indicate the months during which the moths have been taken on the wing.

Dorrigo; Blackheath (3,500 ft.); National Park 2; Rous 4; Pymble 2; Manly 2, 3, 4; Mosman 3; Stanwell Park 2; Killara 4; Hornsby 2, 3; Roseville 2, 3; Waverley 3; Richmond 3; Sydney 2, 3, 4; Lismore; Jervis Bay; Katoomba. Victoria: Moe 2; Caulfield 2; Melbourne; Narnargoon; Beaconsfield 2. Western Australia: King George Sound. 128 males, and 78 females have been examined.

Walker's type of *E. inconclusa,* a male in the British Museum collection, is figured (fig. 5). In this species the colour of the forewings may vary from a dark chocolate-brown through grey to an ochreous-red. The oblique white discoidal fasciate mark is a relatively constant feature. The females have the forewings almost free from markings, and as in the male the colour ranges from brownish-grey to ochreous-red and yellow. The hindwings in both sexes tend to be pinkish-tinged. Sydney is the type locality and the above description is drawn up from freshly-killed specimens.

In life the colours are very bright with a tinge of purple, but the hues are evanescent and fade rapidly after death. In March, 1927, this moth was observed in the National Park near Sydney. Numerous freshly-emerged examples of both sexes were clinging to wet sword-grass and to reed stems in swampy places, at dusk and after dark. The species is variable; all the forms may be taken together.

According to Mr. C. G. L. Gooding this species comes sparingly to lights at Moe, in company with *Abantiades hyalinatus.*

Examples from the Macpherson Range, in Queensland, are perhaps brighter in colour, but they cannot be maintained as a geographical race. The Western Australian record is based on a single faded female from the Australian Museum collection labelled "K.G.S.". With it were associated two males without data. These specimens are less well marked than usual, and have an ochreous appearance not common in Eastern examples. This may, however, be due in part to their state of preservation.

The pupa of this species (fig. 4) is 40 mm. in length and 6 mm. in diameter, pale brown with darker chestnut-brown chitinizations at the anterior extremity; when ready to emerge the colours of the adult are noticeable through the relatively thin epidermis. There are two dorsal and one ventral series of minute transverse serrations on each segment. The foodplant and the details of its life history are unknown, but the occurrence of the newly-emerged moths in swamps suggests that they may feed on the roots of swamp grasses or reeds.

Meyrick concluded that the *Pielus invarius* of Walker belonged to this species, but the type, a female, clearly belongs to a species of the genus *Oxycanus,* and may be sought under the name *O. sordidus.*

JEANA gen. nov.

Antennae long, bipectinate, pectinations long, apex of each armed with three to five stout hairs; in female less developed. Labial palpi long and slender (fig. 10), three-segmented, basal segment longer than second, terminal one-half as long as second. Posterior legs only moderately hairy. Forewings with R_1 and R_2 separately from near base, R_3, R_4, and R_5 out of R_2; R_2 and R_3 branching much nearer to termen than to junction with R_4; R_5 from about two-fifths. Hindwings

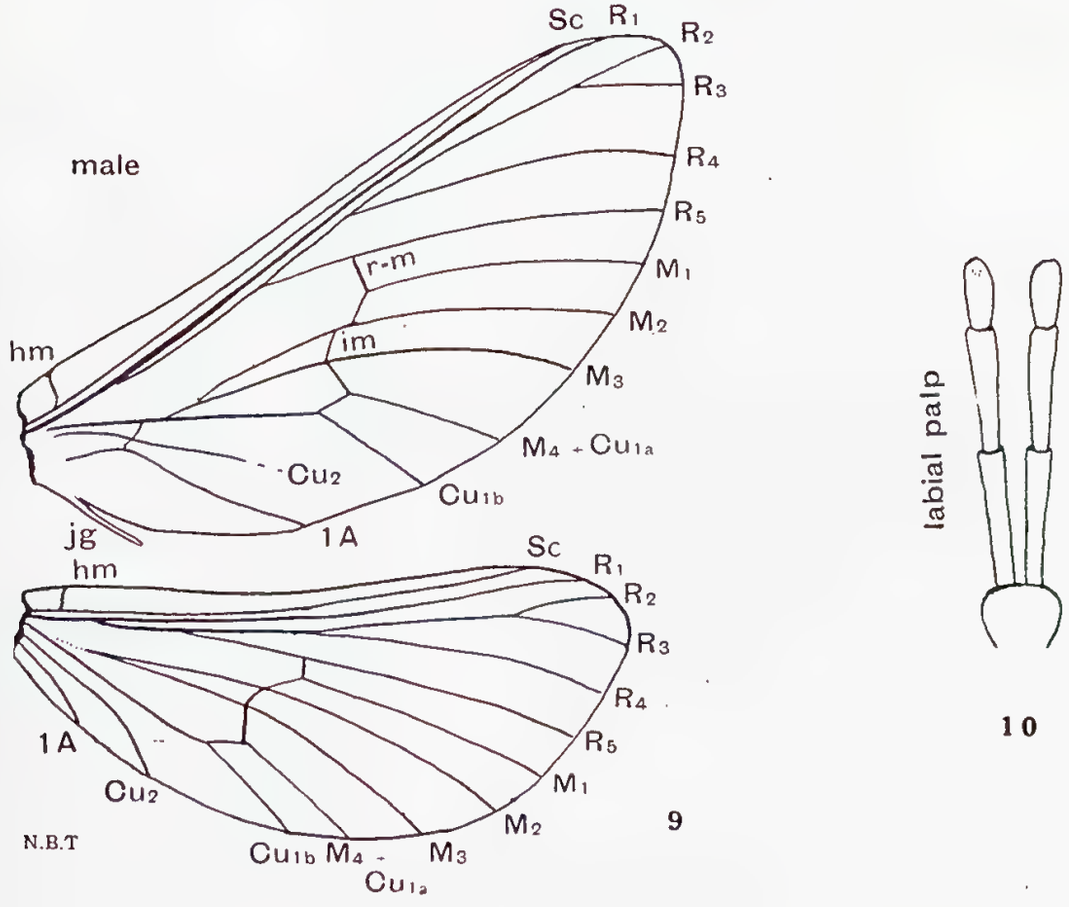

Fig. 9–10. *Jeana delicatula* gen. et sp. nov. 9, male venation; 10, male, labial palpi.

with R_2 and R_3 branching nearer to termen than to junction with R_4; anal area with 1A present as a short vein, visible only in cleared or bleached specimens, 2A absent (fig. 9).

Genotype: *Jeana delicatula* sp. nov.

The small size, different venation, in which the branching of R_2 and R_3 is near the termen, and the highly distinctive palpi serve to mark this genus off from *Oxycanus*, to which it is undoubtedly related. From *Fraus* it differs in the form of the wings, venation, and in the stouter body. It resembles *Elhamma* in that R_1 and R_2 are confluent near the base of the wing, but differs from that genus in the absence of the sexual dimorphism of the venation.

JEANA DELICATULA sp. nov.

Fig. 9-12.

♂ Antennae bright yellowish-brown; palpi smooth-haired, long, brown; head brown, thorax dark brown, abdomen dull brown, paler at base; legs long, slender, smooth-haired, dark brown. Forewings ochreous-brown, brighter along veins and margins of the wing; costa to one-half dark brown; over most of wing an obscure pattern of subrectangular dark brown and grey spots, the latter obscurely margined with pale yellow. Hindwings dull brown, at veins and along margin ochreous-brown. Expanse 42 mm.

♀ Antennae shortly bipectinate, shorter than in male, yellow; palpi yellowish-brown; head and thorax dark grey; abdomen pale fawn, base of abdomen and

Fig. 11–12. *Jeana delicatula* gen. et sp. nov. 11, type, a male, Moe; 12, allotype female, Moe.

legs clothed with fine white hairs. Forewings subhyaline, sparsely scaled, grey, an obscure series of cream-margined dark grey marks from near apex to hind margin at one-half, also a marginal series from near apex to near base. Hindwings grey. Expanse 48 mm.

Loc. Victoria: Moe 4 (April 3, 1934, C. G. L. Gooding, type, a male and allotype female, April 17, 1934, I. 18849, in S. Aust. Mus.); Beaconsfield 4; Neerim. 6 males, 2 females.

This species is probably widely spread in Eastern Victoria, but owing to its relatively small size it escapes notice.

OXYCANUS Walker.

Porina Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1572 (*nec* D'Orbigny, Mollusca, 1852).

Oxycanus Walker, *l.c.*, 1856, p. 1573.

Porina Meyrick, Proc. Linn. Soc. N.S. Wales iv (2), 1889, p. 1119; Trans. N. Zealand Inst., xxii, 1890, p. 206.

Oxycanus Kirby, Syn. Cat. Lep. Het., 1892, p. 892.

Porina Quail, Trans. Ent. Soc. Lond., 1900, pp. 411-432 (life histories).

Oxycanus Eyer, Ent. Soc. Amer. xvii, 1924, p. 305.

Antennae moderate, strongly bipectinate, or feebly bidentate; when strongly bipectinate there is sometimes also a pair of short dentations at the base of each

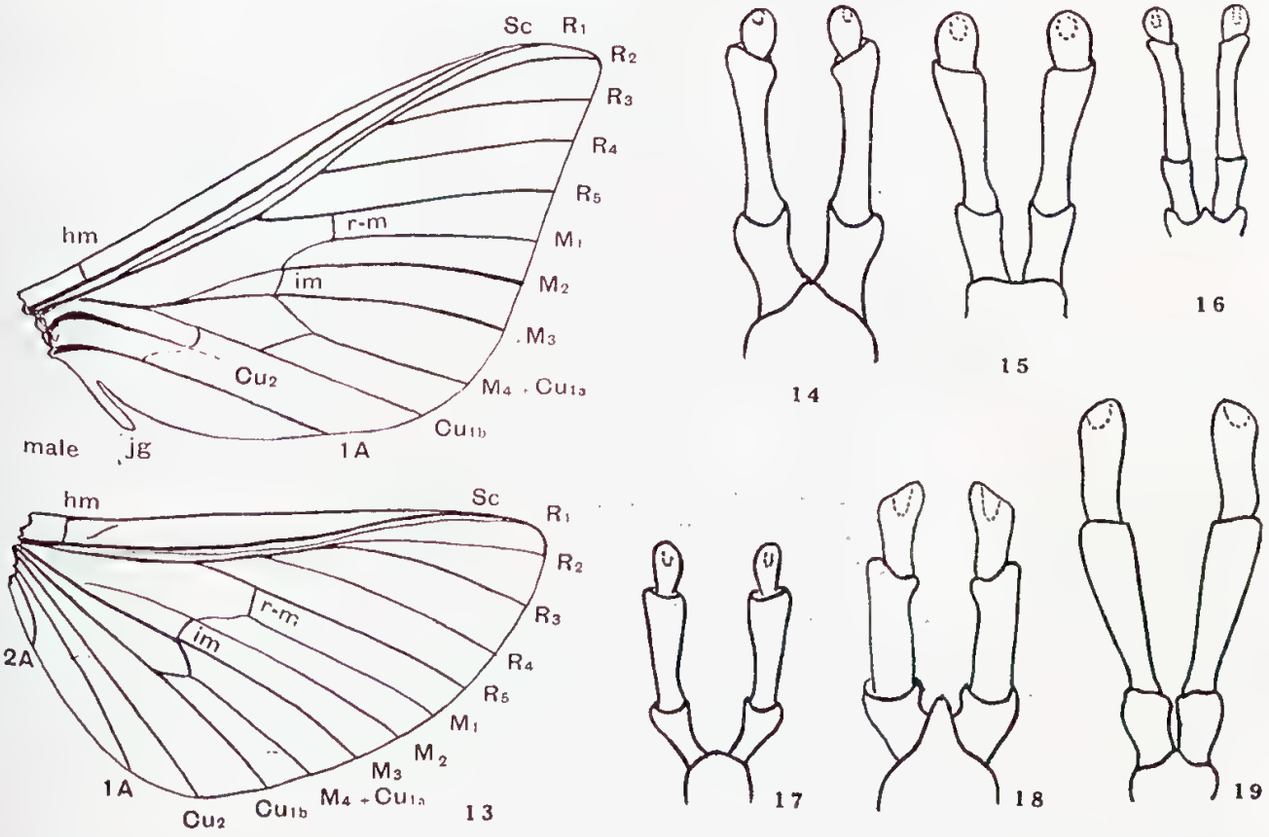

Fig. 13–19. 13, *Oxycanus australis* (Walker), male venation. 14–19. Labial palpi. 14, *O. rosaceus* sp. nov., Moe; 15, *O. stellans* sp. nov., Cockatoo; 16, *O. occidentalis* sp. nov., W. Aust.; 17, *O. sirpus* sp. nov., Ferntree Gully; 18, *O. diremptus* (Walker), Healesville; 19, *O. determinatus* (Walker), Swan River.

segment, pectinations and dentations terminating in tufts of ciliae. Labial palpi moderate, porrected, with basal segment twice as long as wide, second at least three times as long as wide, apical one slightly swollen at apex, and nearly twice as long as wide, clothed with short flattened hairs. Maxillary palpi either present as a single rudimentary subspherical segment, or obsolete. Hind tibiae densely hairy. Forewings with R_1 and R_2 separately from near base, R_3, R_4, and R_5 out of R_2; R_2 and R_3 branching nearer to R_4 than to termen; R_5 from about two-fifths. Hindwings with R_2 and R_3 branching nearer to R_4 junction than to termen; 1A well developed; 2A present as a rudiment near base.

Genotype: *Oxycanus australis* Walker, 1856, nominated by Kirby, 1892.

This is the most extensively distributed of the Australasian genera, being found in all moist temperate and wet sub-tropical parts of Australia, in New Zealand, and at moderate elevations in the mountains of New Guinea. More than seventy species are now described, of which thirty-nine are Australian, and there are in addition others known of which the material is too scanty or poor to be described. By a strange error, Quail has attributed one South Australian species (*O. niphadias*) to Patagonia.

In Australian species of *Oxycanus* the *harpes* of the male genitalia are variously developed, but on the whole offer few characters suitable for specific notice. In *O. sordidus* they are much elongated, slightly incurved at the apex, and feebly clavate. In other species they are only moderately well developed.

The form of the tegumen (Buchanan-White, 1878) ([3]) is of special systematic importance. In *Oxycanus* this structure consists of two lateral chitinized members with dorsal membraneous connections, developed from the highly modified ninth tergite as a hood for the anus and genitalia. The inferior (strictly caudal) margins of this hood are strongly chitinized and are frequently armed with hooks, processes, lobes, and single or seriate spines. This armature is readily made visible in the moth, without dissection, by gently brushing away some of the subapical hairs from the ventral surface of the abdomen. Inspection of the tegumen facilitates the determination of members of an otherwise difficult genus. For detailed work dissections of the genitalia have been prepared and mounted in choral hydrate within a cell. To assist in a ready examination, the accompanying drawings were made of the margin of the left latus of the tegumen as though they were viewed from the right postero-lateral aspect, with the moth held ventral surface upwards; the caudal margin is, in consequence, upwards and the posterior (strictly dorsal or postero-dorsal) extremity is to the right, and the anterior (strictly ventral or antero-ventral) end to the left. The anteriorly projecting portion of the tegumen constitutes the *suspensorium* of Eyer.

Several members of the genus *Oxycanus* are of considerable economic importance because of their depredations on pasture grasses. Part at least of the damage attributed to *Oncopera* is done by *O. fuscomaculatus;* and several other species are probably also grass feeders. In the Mount Gambier district of South Australia the larvae of *O. fuscomaculatus* were found in potato fields, and they have been elsewhere blamed for hollowing out these tubers. Several species of wattles have their roots attacked by species of this genus, for example *O. diremptus* feeds on *Acacia Baileyana* and *A. prostrata*. It is preyed upon by more than one species of frog during the time of emergence from the pupa. This observation, which was first made by Mr. C. G. L. Gooding at Moe, has led to my

([3]) Buchanan-White, F., Trans. Linn. Soc. Lond. Zool., ser. 2, i, 1878, p. 357.

suggestion that the introduction of a species of toad into Australia might assist in the control of *Oncopera* and *Oxycanus*. The Surinam toad *(Bufo agua)* was introduced into Porto Rico a few years ago, with some success, to assist in the control of a ground-burrowing mole-cricket (*Scapteriscus vicinus* Scudder).

As in the study of previous genera I am indebted to the British Museum, and to Mr. W. H. Tams in particular, for photographs of Walker's types; illustrations of some of them are reproduced herein. Most of the figures are natural size; in a few instances they are slightly smaller; the degree of reduction may be noticed by comparison with the dimensions given in the descriptions.

KEY TO THE SPECIES OF OXYCANUS.

a. Palpi moderate; third segment not longer than first.
  b. Caudal margin of tegumen, viewed from side, rather evenly semi-circular in outline; if armed, bearing seriate spines.
    c. Tegumen not armed with conspicuous seriate spines.
      d. Tegumen not strongly arched.
        e. Suspensorial process of tegumen short.
          f. Forewings with many silvery-white markings.
            g. Antennae with ventral surface concave — *australis*
            gg. Antennae with ventral surface not concave — *diremptus*, *f. kershawi*
          ff. Forewings with only few silvery-white markings.
            h. Tegumen with strongly chitinized portion narrow and smooth.
              i. Forewings with strong longitudinal white fascia — *diremptus*
              ii. Forewings without marked longitudinal white fascia — *waterhousei*
            hh. Tegumen with strongly chitinized portion broad and with irregular margin — *lyelli*
        ee. Suspensorial process of tegumen long — *fuscomaculatus*
      dd. Tegumen strongly arched — *perditus*
    cc. Tegumen armed with conspicuous seriate spines.
      j. Suspensorial process long — *janeus*
      jj. Suspensorial process short.
        k. Spines restricted to anterior half of tegumen.
          l. Spines on tegumen four in number — *silvanus*, *carus*
          ll. Spines on tegumen more than four — *herdus*
        kk. Spines not restricted to anterior half of tegumen.
          m. Antennae with strong pectinations.

Fig. 20–43. *Oxycanus*. Latus of tegumen as viewed from side, anterior extremity to the left. 20, *O. australis* (Walker), Launceston; 21, *O. diremptus* (Walker), Healesville; 22, *O. waterhousei* sp. nov., Killara; 23, *O. lyelli* sp. nov., Eltham; 24, *O. perditus* sp. nov., W. Aust.; 25, *O. silvanus* sp. nov., Canberra; 26, *O. herdus* sp. nov., Armidale; 27, *O. beltistus* (Turner), Mount Nebo; 28, *O. ballux* sp. nov., Dorrigo; 29, *O. aurifex* sp. nov., Dorrigo; 30, *O. naias* sp. nov., Gympie; 31, *O. gelidus* sp. nov., Armidale; 32, *O. goldfinchi* sp. nov., Normanhurst; 33, *O. rosaceus* sp. nov., Moe; 34, *O. hamatus* sp. nov., Jervis Bay; 35, *O. stellans* sp. nov., Cockatoo; 36, *O. spadix* sp. nov., Blackheath; 37, *O. loesus* sp. nov., Gordon; 38, *O. occidentalis* sp. nov., W. Aust.; 39, *O. poeticus* sp. nov., Denmark, W. Aust.; 40, *O. promiscuus* sp. nov., Denmark, W. Aust.; 41, *O. sordidus* (Herrich-Schaeffer), Eaglehawk Neck; 42, *O. incanus* sp. nov., Jervis Bay; 43, *O. barnardi* sp. nov., Toowoomba.

n. Abdomen and base of hindwings salmon-pink .. .. .. *beltistus*
nn. Abdomen and base of hindwings not salmon-pink.
o. Wings subhyaline.
p. Forewings yellowish-brown with yellow markings .. *ballux*
pp. Forewings grey with yellow markings .. .. *aurifex*
oo. Wings opaque.
q. Forewings ochreous brown with brownish-black markings .. .. *naias*
qq. Forewings grey with creamy-white markings .. .. .. *gelidus*
mm. Antennae with pectinations almost obsolete .. .. *goldfinchi*
bb. Caudal margin of tegumen, viewed from side, not evenly semi-circular in outline (owing to irregular spines or protuberances).
r. Tegumen with large median, usually outwardly bent projection or lobe.
s. Median projection of tegumen acutely terminated.
t. Suspensorial spine with recurved or hooked anterior extremity.
u. Suspensorial spine short .. .. *rosaceus*
uu. Suspensorial spine long .. .. *hamatus*
tt. Suspensorial spine without recurved extremity.
v. Tegumen armed near posterior extremity.
w. Posterior portion of tegumen spined.
x. Only single posterior spine present.
y. Posterior spine remote from median one.
z. Posterior spine large .. *stellans*
zz. Posterior spine very small .. .. *spadix*
yy. Posterior spine close to median one .. *loesus*
xx. Four posterior spines present *occidentalis*
ww. Posterior portion of tegumen lobed.
a. Lobe large, with undulating or serrated margin.
b. Tegumen with an external spine absent .. *poeticus*

bb. Tegumen with an external spine present .. .. *promiscuus*

aa. Lobe small, with one or more spines .. .. .. *sordidus*

vv. Tegumen not armed near posterior extremity .. .. .. *nuptialis*

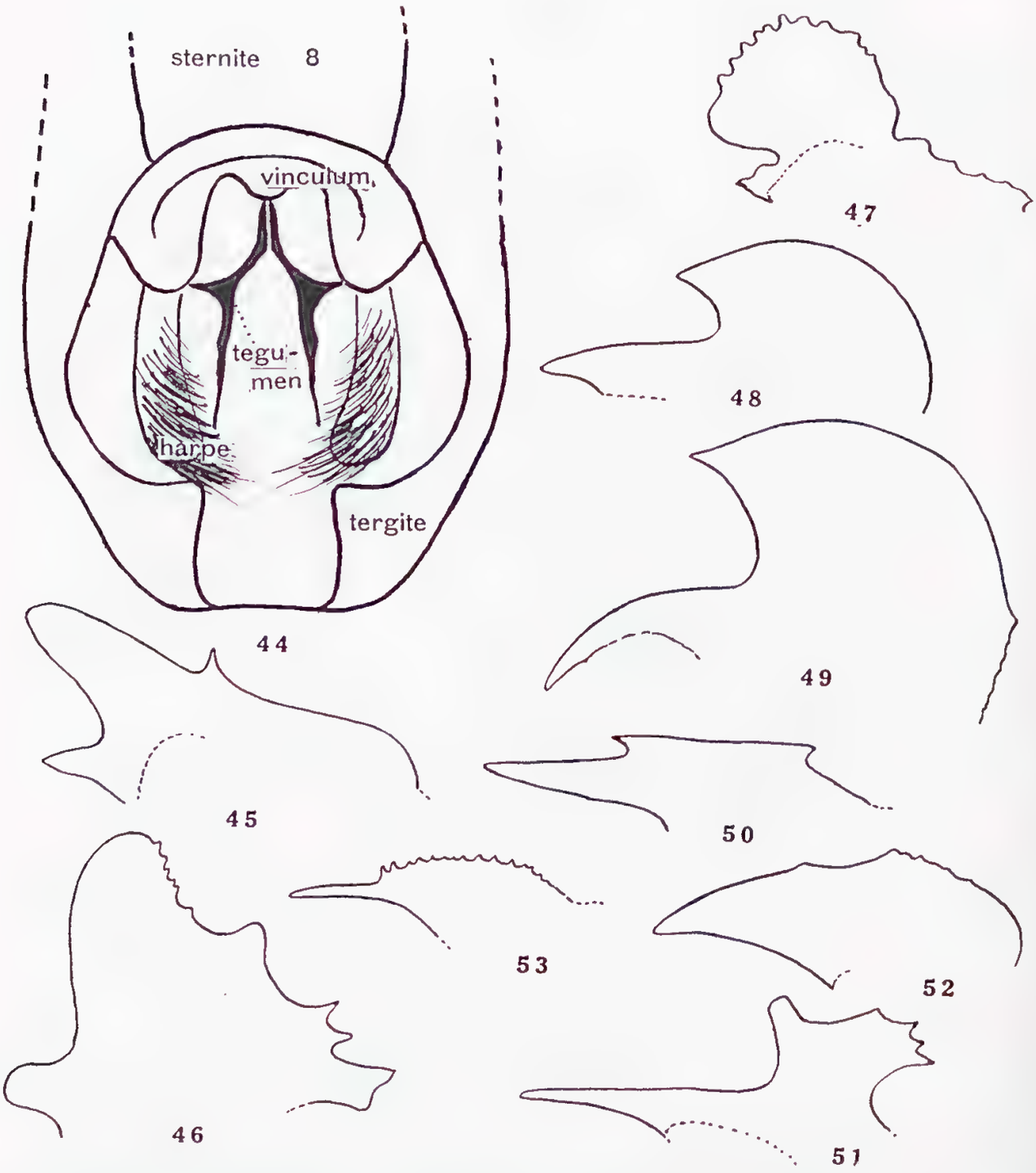

Fig. 43–53. *Oxycanus.* 44, *O. nuptialis* sp. nov., male, Mt. Kosciusko, ventral view of apex of abdomen to show tegumen. 45–53. Latus of tegumen as viewed from side, anterior extremity to left. 45, *O. niphadias* (Meyrick), Blackwood; 46, *O. goodingi* sp. nov., Moe; 47, *O. sirpus* sp. nov., Croydon; 48, *O. subvarius* (Walker), Ulverstone; 49, *O. lamnus* sp. nov., Manly; 50, *O. sphragidias* (Meyrick), Launceston; 51, *O. determinatus* (Walker), Swan River; 52, *O. fuscomaculatus* (Walker), Launceston; 53, *O. janeus* sp. nov., Tumbarumba.

ss. Median projection of tegumen not acutely terminated, but rounded or lobed.
c. Median lobe of tegumen simple.
d. Large post-median spine present .. *incanus*
dd. Large post-median spine not present.
e. Median lobe posteriorly directed .. *barnardi*
ee. Median lobe anteriorly directed .. *niphadias*
cc. Median lobe of tegumen not simple.
f. Serrations present on posterior margin of lobe .. .. *goodingi*
ff. Serrations not restricted to posterior margin of lobe .. *sirpus*
rr. Tegumen without large, median, usually outwardly bent projection or lobe.
g. Tegumen with anteriorly directed, post-suspensorial spine or projection.
h. Median portion of tegumen arched.
i. Anterior suspensorial spine short and straight .. .. *subvarius*
ii. Anterior spine long and curved .. *lamnus*
hh. Median portion of tegumen straight .. *sphragidias*
aa. Palpi long; third segment longer than first .. .. *determinatus*

NOT KEYED.

Oxycanus maculosus (Felder), *O. aedesimus* (Turner), and *O. byrsus* (Pfitzner).

OXYCANUS AUSTRALIS Walker.

Fig. 13, 20, 54-55.

Oxycanus australis Walker, List Lep. Ins. Brit. Mus. vii, 1856, p. 1574.
Porina australis Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1121.

♂ Antennae reddish-ochreous, moderate, pectinations 3, set obliquely so that the antennae are concave below. Head, thorax and legs grey; abdomen ochreous, towards base a little more reddish. Forewings greyish-brown, costa narrowly darker; a series of silvery-white spots over whole of wing and a longitudinal white fascia from base to R_5 at about two-thirds. Hindwings uniformly ochreous, densely clothed with reddish-tinged bright ochreous hairs at base. Expanse 90 mm.

♀ Antennae ochreous, short, feebly bidentate. Head, thorax, and apex of abdomen ochreous fawn, base of abdomen dull ochreous. Forewings with apex acute, pale ochreous-fawn with faint paler ochreous and grey markings somewhat as in male, but larger and obscure. Hindwings with apex rather acute, hyaline, pale grey with dense pale ochreous hairs at base. Expanse 104 mm.

Loc. Tasmania: Maitland; Launceston 5; Sheffield; Longford 4. Victoria (allotype female I. 18850 in S. Aust. Mus.); Wilson Promontory 5; Brighton; Kewell; Gippsland; Melbourne 5. South Australia: Robe 4; Mount Gambier 5, 6. 21 males, 2 females.

I am indebted to Mr. W. H. Tams for the following information regarding the type in the British Museum: "Walker's type is one of the two specimens

Fig. 54–55. *Oxycanus australis* (Walker). 54, male, Robe; 55, type, a male, Tasmania. (British Museum Collection).

listed . . . . under his description on p. 1574, as *c, d.* Van Dieman's Land. Presented by J. G. Children, Esq. These two specimens bear old registration numbers $\frac{40.6.29}{5.}$ and $\frac{40.6.29}{6.}$". The type is the last-named example.

The male described is one from Maitland, the female is from Victoria (ex Lucas Coll.). The Maitland example agrees very well with the photograph of the type and with an example in the National Museum Collection, which was identified by Walker himself. The South Australian examples have the hind-wings sub-hyaline, with a subterminal series of faint grey maculae, like water-

marks, but the form is not sufficiently marked to warrant even sub-specific separation.

The late F. M. Littler, of Launceston, took male examples of this species at lights, in May. In Tasmania a melanic form also occurs; in it the forewings are dark brown and the hindwings a dull brown, except at base, where they are reddish-ochreous. Some examples have the silvery-white marks enlarged; in others they may be obsolescent. Nothing is known regarding the life history.

O. maculosus (Felder) has been considered to belong to this species, but the differences observable in the photograph of the type (fig. 127), particularly in the form of the wing, should be sufficient to separate it. Unfortunately it has not been possible to have the genitalia of this species examined; the unique type is in the Tring collection.

The figure of *O. australis* given by Pfitzner and Gaede is probably based on Felder's *O. maculosus* and does not adequately represent the present species.

O. australis differs from *O. diremptus* in the form of the antennae, which are concave beneath; a form of the latter species resembles it in wing markings but is structurally distinct.

The male genitalia have the tegumen evenly arched, and practically unarmed, except for several minute projections on the anterior half, the strongly chitinized portion of the posterior extremity of the tegumen is not produced to the same degree as in *O. diremptus*.

OXYCANUS DIREMPTUS (Walker).

Fig. 18, 21, 56-57.

Porina dirempta Walker, List Lep. Ins. Brit. Mus., xxxii, 1865, p. 597.
Porina dirempta Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1121.
Porina kershawi Lucas, Proc. Linn. Soc. N.S. Wales, vi (2), 1891, p. 282.

♂ Antennae dark reddish-ochreous, moderate, pectinations 3, conspicuous apical tufts present, smaller paired projections also present at base of each segment; head, thorax, and legs dark chocolate-brown, above with a greyish tinge; abdomen salmon-pink, base and apex slightly darker. Forewings with costal margin narrowly dark chocolate-brown, ground colour mixed reddish-ochreous and chocolate-brown; a transverse white fascia from costa at ¾ths to hind margin, a white streak from base to meet a broad terminal white suffusion; hind margin rather broadly suffused with grey scales; there are two silvery-white subcostal marks. Hindwings salmon-pink with traces of darker scales in an area near hind margin. Expanse 76 mm.

♀ Antennae reddish-ochreous, short, feebly bidentate; head and thorax chocolate-brown with a grey tinge; abdomen salmon-pink, at apex dull brown.

Forewings chocolate-brown with a white fascia from base to one half termen, and traces of dark grey markings in outer third. Hindwings bright salmon-pink. Expanse 110 mm.

Loc. Victoria: Moe 4 (topotype male April 17th, 1934, and allotype female April 25th, 1932, C. G. L. Gooding I. 18851 in S. Aust. Mus.); Gisborne 3, 5;

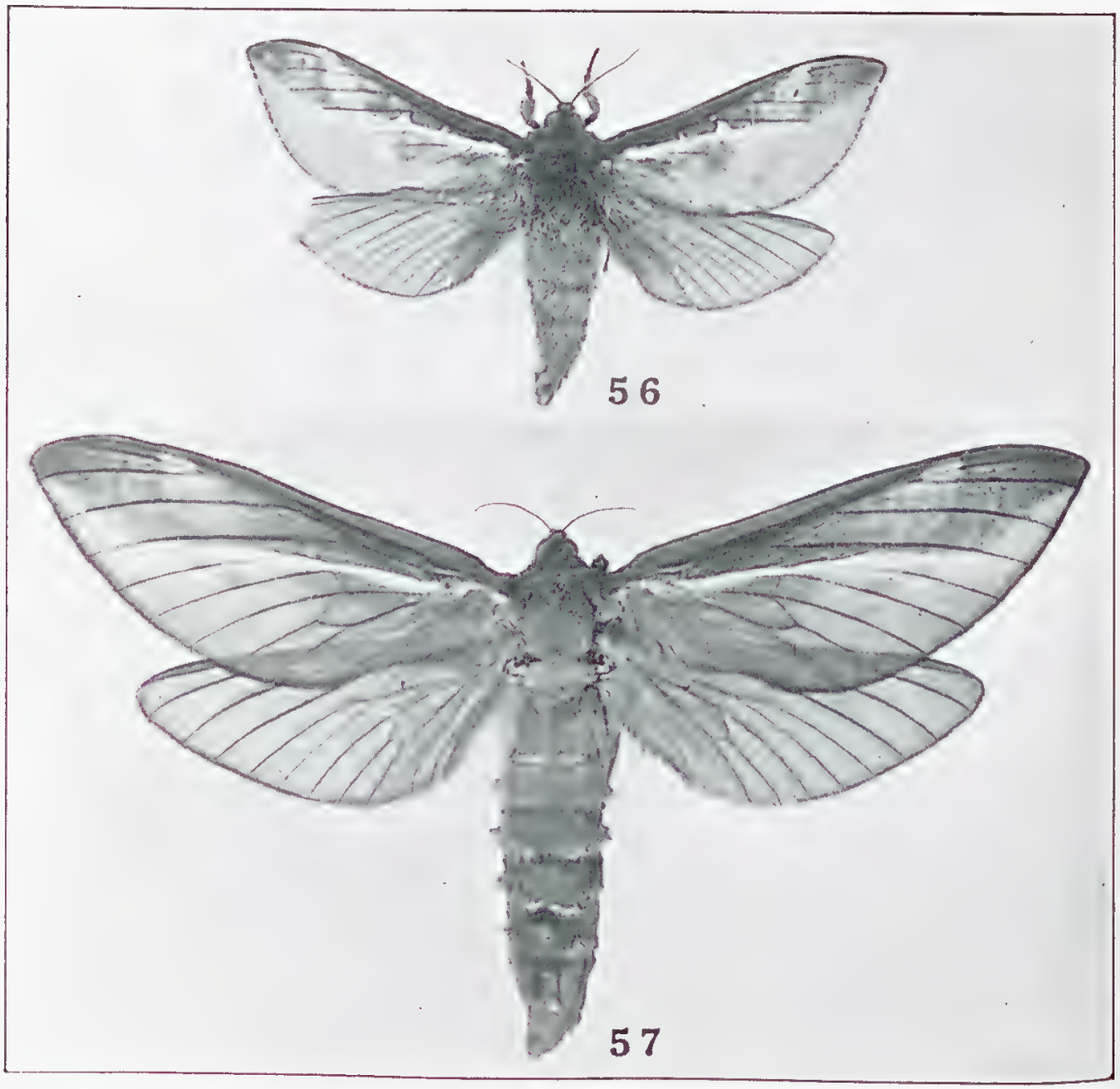

Fig. 56–57. *Oxycanus diremptus* (Walker). 56, type, a male, Southern Australia; 57, allotype female, Moe.

Toolangi 4; Healesville 5; Beaconsfield 4, 5; Ferntree Gully 4. *f. kershawi,* Eltham; Moe 4, 5. 41 males, 16 females.

The type, which is in the British Museum, has been figured. The example described above was selected from many examples taken at Moe, because of its close resemblance in detail to the type specimen. The allotype female, described above, is also from Moe.

The locality of Walker's type is given as "South Australia", which was probably used, as in other cases, in the sense "Southern Australia". The species is not known in our State, and I therefore nominate Moe, in Victoria, as the type locality. This species is allied to *O. australis*, from which it differs markedly in the structure of the antennae, and to a lesser degree in the male genitalia. The pectinations of the antennae are so set upon the segment that they do not form a concavity on the lower surface, i.e. they are transverse; in *O. australis* they are set at an obtuse angle, forming in the aggregate a well-marked inferior groove. Some examples are superficially difficult to separate from *O. australis* owing to the marked resemblance in wing pattern. The *O. australis* like examples may be known as *O. diremptus f. kershawi* (Lucas). This form occurs in the same localities as the typical one, and both may be obtained out of pupae emerging from beneath the same tree; it is therefore not a geographical race. Structurally the specimens are the same as *O. diremptus* examples, and are thus readily distinguishable from *O. australis*. Lucas's type specimen of this form is from Eltham (I. 18852 in S. Aust. Mus.).

The male genitalia differ from those of *O. australis* in the greater prolongation of the posterior extremity of the tegumen. This has the margin evenly curved and devoid of armature.

The larvae feed on the roots of wattles (*Acacia Baileyana* and *A. prostrata*), and from their abundance must seriously affect the growth of these trees. On April 20th, 1930, Mr. C. G. L. Gooding obtained freshly-emerged moths, empty pupal shells, and many loose wings of both sexes of the *O. diremptus* at Moe. Many of the newly-emerged moths had been preyed upon by frogs, especially *Hyla ewingi* var. *calliscilis* and *Lymnodynastes dorsalis* var. *dumerili*. The pupal shells, which are pale castaneous-brown, vary in length from 44-48 mm. (males), and from 55-60 mm. (females); they indicate that the pupa was relatively short and stout. The mask bears paired submedian blunt-pointed facial protuberances, a median buccal eminence, and at the base of the antennal sheath there are two stout heavily chitinized spines, internal to which there is a small rounded eminence bearing a pair of long fine sensitive setae; other setae occur at the base of the buccal portion of the mask.

Mr. E. Gooding has taken several pairs at Moe on a different site from that where Mr. C. G. L. Gooding has captured so many examples. They show marked variation from the normal form. There are also some specimens before me from Woodford, in New South Wales, which may belong to this species, but they appear to be aberrant in colour and markings.

The figure by Pfitzner and Gaede (in Seitz Macrolepidoptera x, 1933, pl. 76d) under this name does not represent the species.

OXYCANUS WATERHOUSEI sp. nov.

Fig, 22, 58-59.

♂ Antennae reddish-ochreous, moderate, pectinations stout, 2; head, thorax, and forelegs greyish-fawn, abdomen reddish-ochreous. Forewings reddish-ochreous with paler suffusions and dark brown markings; two large dark-brown-

Fig. 58–59. *Oxycanus waterhousei* sp. nov. 58, type, a male, Wentworth Falls; 59, allotype female, Killara.

margined silvery-white spots between r-m vein and base; a series of dumb-bell-shaped brown marks parallel to termen, each with a pair of dull white centres. Hindwings bright reddish-ochreous, densely clothed with hair at base. Expanse 82 mm.

♀ Antennae reddish-ochreous, short, feebly bipectinate; head and thorax pale chocolate-brown, abdomen pale reddish-ochreous. Forewings reddish-och-

reous, with paler suffusions on outer third; inner margin broadly suffused with pale chocolate-brown, a silvery-white spot at r-m vein. Hindwings uniformly reddish-ochreous. Expanse 116 mm.

Loc. N.S. Wales: Wentworth Falls 5 (type, a male, I. 18853 in S. Aust. Mus.); Killara 5, 6 (G. A. Waterhouse allotype female I. 18854); Mittagong 4; Roseville 5; Blackheath; Robertson 4. Queensland: Stanthorpe. 9 males, 2 females.

The pair of large white marks on forewings is a comparatively constant feature, traces of which are also present in the female. Occasional examples of *O. diremptus* approach this species in appearance but the genitalia of the male are different.

There are several undescribed specimens in our collection from localities in Queensland and New South Wales, which are quite different from this species in general appearance and yet have very similar structural characters in the genitalia. When further material is available it will probably be found that they include several distinct species.

OXYCANUS LYELLI sp. nov.

Fig. 23, 60-61.

♂ Antennae reddish-ochreous, rather short, pectinations stout, closely set, 1½; head and thorax dark grey; abdomen reddish-ochreous, at apex paler. Forewings pale reddish-ochreous with traces of darker markings, a silvery-white fascia from base to termen, and a broad transverse whitish suffusion. Hindwings reddish-ochreous, rather hairy at base. Expanse 80 mm.

♀ Antennae reddish-ochreous, slender, obsoletely bidentate; head and thorax pale chocolate-brown; abdomen reddish-ochreous. Forewings pale reddish-ochreous with traces of darker markings and of a white-centred brown mark at r-m vein; inner margin clothed with chocolate-brown scales. Hindwings subhyaline, pale reddish-ochreous, densely clothed with reddish-ochreous hairs at base. Expanse 106 mm.

Loc. Victoria: Riddell 4; Eltham (type a male, W. W. Smith, I. 18855 in S. Aust. Mus.); Wooryallock 4 (allotype female, April 10, 1921, L. B. Thorn, I. 18856 in S. Aust. Mus.); Healesville 4; Gisborne 4; 7 males, 2 females.

The male figured is a paratype; the female is the allotype. This species is closely allied to *O. diremptus*, from which it differs in the wing markings and in the form of the tegumen of the male. A male example labelled "Roseville, N.S. Wales" ex Lower collection, probably belongs to this species, but there may have been some mistake in the labelling.

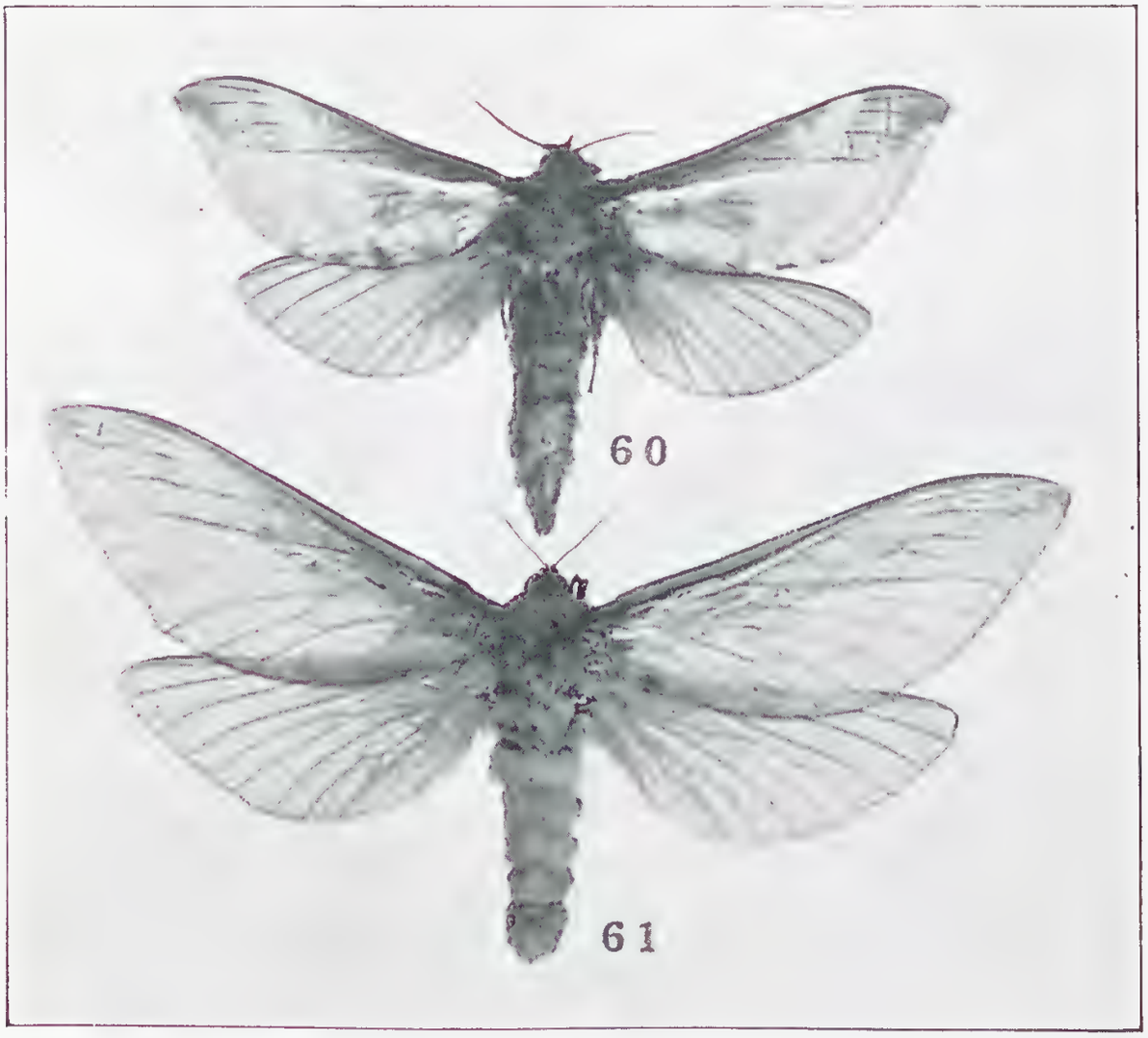

Fig. 60–61. *Oxycanus lycelli* sp. nov. 60, paratype male, Riddell; 61, allotype female, Wooriyallock.

OXYCANUS FUSCOMACULATUS Walker.

Fig. 52, 62-65.

Oxycanus fuscomaculatus Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1574.
Oxycanus pardalinus Walker, *l.c.*, xxxii, 1865, p. 598.
Porina fuscomaculata Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1120.
Porina fuscomaculata Pfitzner and Gaede, Seitz Macrolep., x, 1933, p. 839.
Oxycanus fuscomaculatus Eyer, Ann. Ent. Soc. Amer. xvii, 1924, p. 305.

♂ Antennae bright yellow, ample, pectinations long and slender, 5; head and thorax dark brown, abdomen slightly paler. Forewings dark brown, with some pale yellow scales and darker brown markings, a subrectangular black spot half-way between r-m vein and base. Hindwings subhyaline, with apical half pale grey, at veins and margins darker, basal half pale orange-yellow. Expanse 73 mm.

♀ Antennae short, pectinations 1; head, thorax, and abdomen rather uniformly greyish-brown, wings hyaline, greyish-brown; traces of a darker mark at r-m vein. Expanse 78 mm.

Loc. New South Wales: Lithgow 5. Victoria: Croydon 5, 6; Box Hill 5; Mooney Gap; Pakenham 6; Gisborne 4, 5, 6; Evelyn 6; Beaconsfield 6; Lower Ferntree Gully 6; Macedon 4, 5; Hawthorn 5; Wandin 5; Narnargoon; Moe 5, 6; Cunningham 5; Melbourne; Balwyn 6. Tasmania: Lefroy 6; Sandford; Launceston 5; Piper River. South Australia: Penola 5; Yahl 5, 6; Mt. Gambier; Morack. Western Australia: Quairading. 272 males, 42 females.

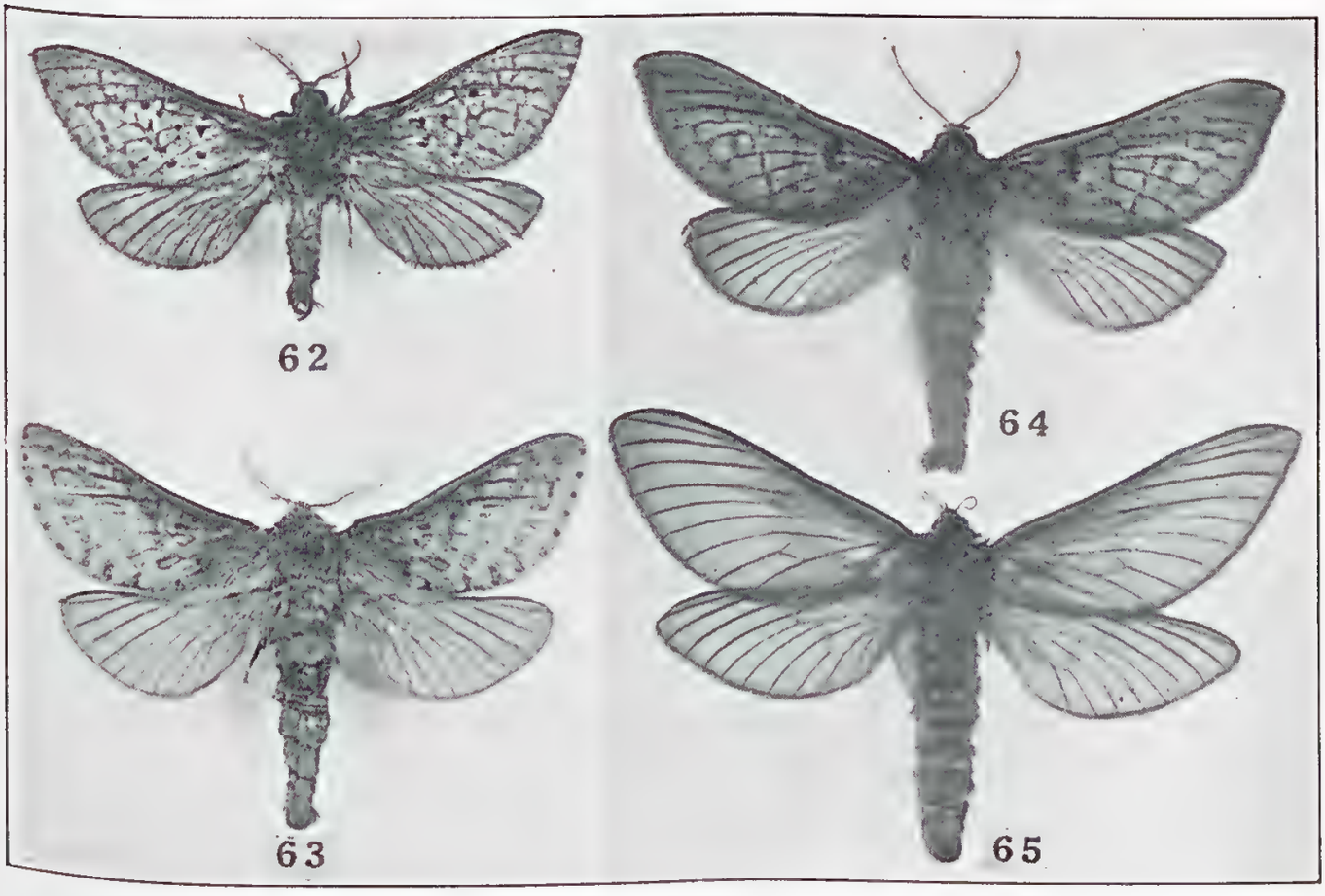

Fig. 62–65. *Oxycanus fuscomaculatus* (Walker). 62, type, a male (British Museum Collection); 63, male, Southern Australia (type of *pardalinus* Walker, in British Museum Collection); 64, male, Moe; 65, female, Moe.

The described examples are from Moe; they differ from the figure of the type form in the presence of the yellowish suffusion on abdomen and base of hindwings (I. 18857 in S. Aust. Mus.). This is a widely-spread and variable species. The type of *O. pardalinus* Walker is stated to be from "South Australia"; this means "Southern Australia". Several geographic races should be distinguishable when more systematic collecting has been done, and the type locality satisfactorily established.

Mr. E. Guest had two pupae brought to him in April, 1896; they had been

found by a person digging potatoes at Morack (Mt. Gambier). They emerged in May; one proved to be a female. The pupa is very long and active, yellow, with head region and wing cases nearly black. The larva has been blamed for hollowing out potatoes in the field. A female was taken by the late Mr. A. M. Lea, at Piper's River, Tasmania; it was attracted to lights.

OXYCANUS PERDITUS sp. nov.

Fig. 24, 66.

♂ Antennae ochreous, pectinations $2\frac{1}{2}$ (only partly preserved). Head and thorax dark brown, abdomen salmon-pink. Forewings rather uniformly dull brown, with costa a little darker, a series of greyish-white marks, an inverted L-shaped one at r-m vein, a series of four forming a linear series across middle of

Fig. 66. *Oxycanus perditus* sp. nov. type, a male, W. Australia.

wing from M_1 to Cu_{1b}; a subterminal series of six smaller ones and four irregularly shaped ones in region of the radial veins; ciliae concolorous with wings. Hindwings pale brown with basal third pink, densely clothed with salmon-pink hairs. Expanse 67 mm.

Loc. Western Australia (type, a male, I. 18858 in S. Aust. Mus.), 1 male.

The only specimen was obtained, without data, from a collection originating in South-Western Australia. The smooth semi-circular margin to the tegumen of the male genitalia at once distinguishes it from all its congeners. In general appearance it seems to be close to aberrant specimens of *O. sordidus*, from which it differs widely in the form of the tegumen of the male genitalia. The salmon-pink base to the hindwings is characteristic of many species of the genus.

OXYCANUS JANEUS sp. nov.

Fig. 53, 67-69.

♂ Antennae bright ochreous, moderate, pectinations long, slender, 5; head and thorax dark greyish-brown; abdomen paler. Forewings dark greyish-brown with obscure patches of paler brown scales embracing traces of dark brownish-black markings (in some varietal specimens several of these are more defined, and contain dull white ocelli). Hindwings subhyaline, dull greyish-brown, base dull ochreous. Expanse 66 mm.

Fig. 67–69. *Oxycanus janeus* sp. nov. 67, type, a male, Tumbarumba; 68, paratype male, Tumbarumba; 69, allotype female, Tumbarumba.

♀ Antennae ochreous, short, feebly bipectinate. Head, thorax, and abdomen pale greyish-brown. Forewings greyish-brown with obscure darker grey markings; two well defined dull black marks between r-m vein and base. Hindwings greyish-brown, base slightly browner. Expanse 89 mm.

Loc. N.S. Wales: Tumbarumba 5 (May 21, 1929, R. J. Tillyard, type a male, and allotype female, I. 18859 in S. Aust. Mus.). 11 males, 4 females.

This species is allied to *O. fuscomaculatus,* from which the male differs in the positions of the obscure wing markings, in the occasional presence of a large white ocellate mark internal to the radio-median cross vein (fig. 68), and in the very different tegumen, which has a long narrow suspensorial process and a serrated margin. Most of the known examples were taken on the one evening. Nothing has been reported regarding its life history.

OXYCANUS SILVANUS sp. nov.

Fig. 25, 70-72.

♂ Antennae bright yellow, pectinations 3; head above dull brown, beneath blackish-brown; palpi short, erect, dark brown, thorax dull greyish-brown, abdomen somewhat paler ochreous. Forewings dull greyish-brown with numerous pale ochreous or dull white marks, each containing one or at most two greyish-brown spots. Hindwings greyish-brown, base clothed with dense but short ochreous-brown hair, ciliae concolorous. Expanse 67 mm.

Loc. New South Wales: Canberra 6 (June 5, 1929, G. A. Waterhouse, type a male, I. 18860 in S. Aust. Mus.); Jenolan Caves 6. Victoria: Seymour 6. 20 males.

Fig. 70–73. *Oxycanus silvanus* sp. nov. 70, type, a male, Canberra; 71, male, Jenolan Caves; 72, male, Seymour; 73, *Oxycanus carus* sp. nov., type, a male, Armidale.

This species is either somewhat variable or separations based on the characters of the male tegumen are insufficient. A series of ten males taken with the type show a transition towards the form shown in fig. 72, from Seymour, in which the forewing markings are obsolete and the hindwings are broadly pale reddish-ochreous. Two unlocalized specimens from the J. Hopson Collection possess a large radio-median white spot, and a second one or traces of one about half way to base. The next species possesses very similar genitalia, but differs in wing form and disposition of the markings. The tegumen usually bears four spines on the anterior portion of the margin.

OXYCANUS CARUS sp. nov.

Fig. 73.

♂ Antennae pale yellow, ample, pectinations long, slender, pubescent, 4; head and thorax pale fawn, abdomen pale reddish-ochreous. Forewings pale brown, with pale yellow suffused areas around brown markings. Hindwings pale reddish-ochreous, tending to pale yellow. Expanse 83 mm.

Loc. New South Wales: Armidale (April, 1928, type, a male, I. 18861 in S. Aust. Mus.). Queensland: Stanthorpe; 2 males.

The tegumen of this species, which was recognized after the key had been completed, is similar to that of *O. silvanus,* from which it is distinct in the form of the wings, and in details of the disposition of the wing markings. It is also allied to *O. herdus,* in which the markings are more symmetrically arranged. The Stanthorpe example is smaller (75 mm.) and the hindwing is lemon-yellow, except at base, which is bright ochreous, and concolorous with the abdomen.

OXYCANUS HERDUS sp. nov.

Fig. 26, 74-75.

♂ Antennae pale fawn, rather long, pectinations long, pubescent, 3; head and thorax pale fawn, abdomen ochreous with a faintly pink tinge. Forewings pale fawn, with three transverse series of regularly arranged fawn spots, surrounded by pale ochreous. Hindwings pale ochreous, at base with a pink tinge. Expanse 76 mm.

♀ Antennae pale ochreous, short, bipectinate, 1; head, thorax, and apex of abdomen pale fawn, base of abdomen pale ochreous. Forewings pale ochreous with a faint irregular grey suffusion near apex and along inner margin. Hindwings pale fawn with basal portion broadly pale ochreous. Expanse 96 mm.

Loc. New South Wales: Armidale (June 4, 1927, R. E. Barnard, type, a male, and allotype female, I. 18862 in S. Aust. Mus.). 1 male, 1 female.

This species emerges about two months after *O. carus*, to which it is closely allied. It differs from both *O. carus* and *O. silvanus* in the more regular arrangement of the markings on the forewings. The anterior portion of the tegumen of the male genitalia bears about eight spines.

Fig. 74–75. *Oxycanus herdus* sp. nov. 74, type, a male, Armidale; 75, allotype female, Armidale.

OXYCANUS BELTISTUS (Turner).

Fig. 27, 76.

Porina beltista Turner, Trans. Roy. Soc. S. Aust., l. 1926, p. 155.

♂ Antennae reddish-ochreous, moderate, pectinations short, stout, 1-1½; apex of each pectination with large tuft of ciliae; head and thorax ochreous-brown; abdomen pale red. Forewings ochreous-brown, slightly darker towards base, costa suffused with darker brown from base to ⅔rds; traces of obscure brownish spots and suffusions towards apex. Hindwings along costa and hind margin pale red, tending to pink, brighter near base, centre of wing obscurely

tinged with grey, apex tinged with ochreous; ciliae ochreous; wings beneath reddish-ochreous. Expanse 100 mm.

Loc. Queensland: Mount Nebo (May 27, 1923, type, a male, in Turner Collection); Blackbutt 4. 3 males.

The three examples under examination differ considerably from each other in the markings of the forewings. Further material may show that the Blackbutt examples are not conspecific with the type from Mt. Nebo (which is near Brisbane). The above description, except for that of the antennae and head, applies particularly to the type example, in which the head is wanting. In one Blackbutt

Fig. 76. *Oxycanus beltistus* (Turner), type, a male, head mutilated, Mt. Nebo.

example there is a white fascia from base to ½ termen, where it becomes diffused. The hindwings are pale ochreous, tinged with salmon-pink. In the other the forewings are dark brown, the fascia is absent, and there are two large conspicuous silvery-white spots in disc; the inner one rectangular and enclosing a dark spot; the hindwings have a grey suffusion as in the type example.

The members of this and the five succeeding species are related by the form of the teguminal margin of the male genitalia, which bears a series of large spines. These do not vary greatly in the species. The antennae differ markedly in the degree of pectination in the different species, and the form of the wing and the markings appear to yield excellent specific characters. All the species are rare, and appear to be restricted to the various sub-tropical forest or "brush" areas in New South Wales and Southern Queensland; no female examples have yet been taken, and there are doubtless species still to be discovered.

OXYCANUS BALLUX sp. nov.

Fig. 28, 77.

♂ Antennae reddish-ochreous, short, feebly bipectinate, 1-1¼; head and thorax pale ochreous-brown, abdomen dark chocolate-brown, apex with a pale brown tuft. Forewings pale ochreous-brown with obscure darker, transverse, suffused marks at one-half and near termen; brown-margined yellow spots below R_5 and M_1 veins; a slightly larger one at r-m vein and another, still larger, half-

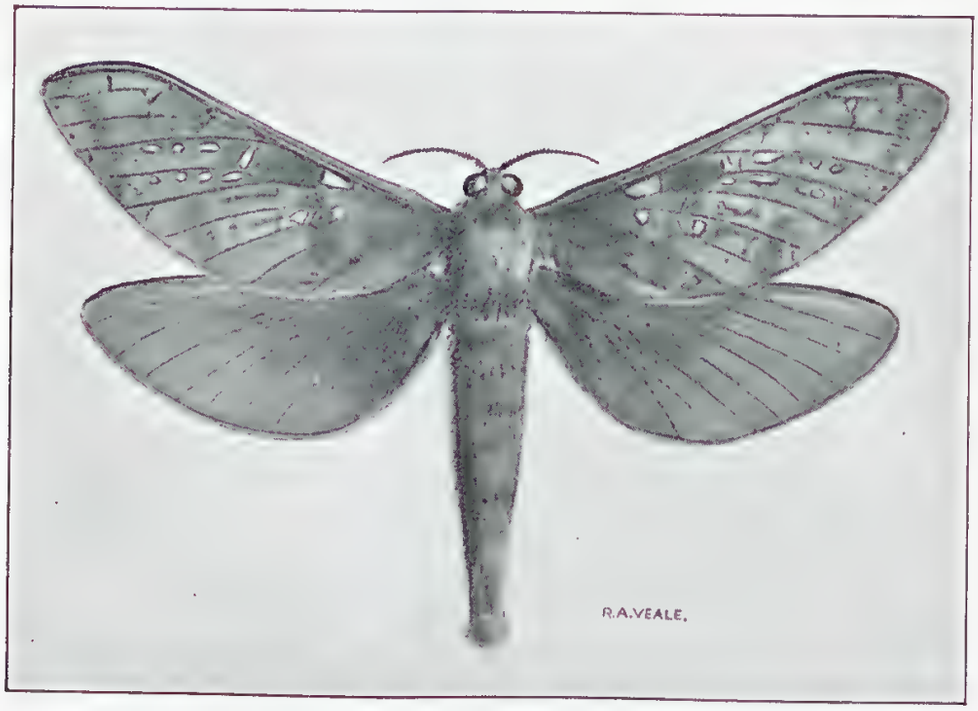

Fig. 77. *Oxycanus ballux* sp. nov., type, a male, Dorrigo.

way to base. Hindwings sub-hyaline, dark chocolate-brown, costa narrowly ochreous. Expanse 90 mm.

Loc. New South Wales: Dorrigo (R. J. Tillyard ex. Lower Collection, type, a male, I. 18863 in S. Aust. Mus.). 1 male.

Allied to *O. gelidus*, from which it differs in the form of the scales of the forewings, which are narrower and more widely-spaced, giving the wings a lustrous appearance. The tegumen of the male genitalia is of much more fragile appearance, with larger spines, and a chitinized margin narrower than in any of the other members of the *O. beltistus* group.

OXYCANUS AURIFEX sp. nov.

Fig. 29, 78.

♂ Antennae reddish-ochreous, long, bipectinate, 2; head and thorax greyish-fawn, abdomen paler fawn. Forewings subfalcate at apex, greyish-brown with

numerous faint hour-glass-shaped pale marks, and obscure paired dark brown spots with obscure ochreous centres; a larger yellow spot at r-m vein, and another half-way to base, also a few scattered smaller ones in discal region of wing; a series of dull golden-yellow blotches grouped about the base of wing. Hindwings hyaline, dull greyish-brown. Expanse 98 mm.

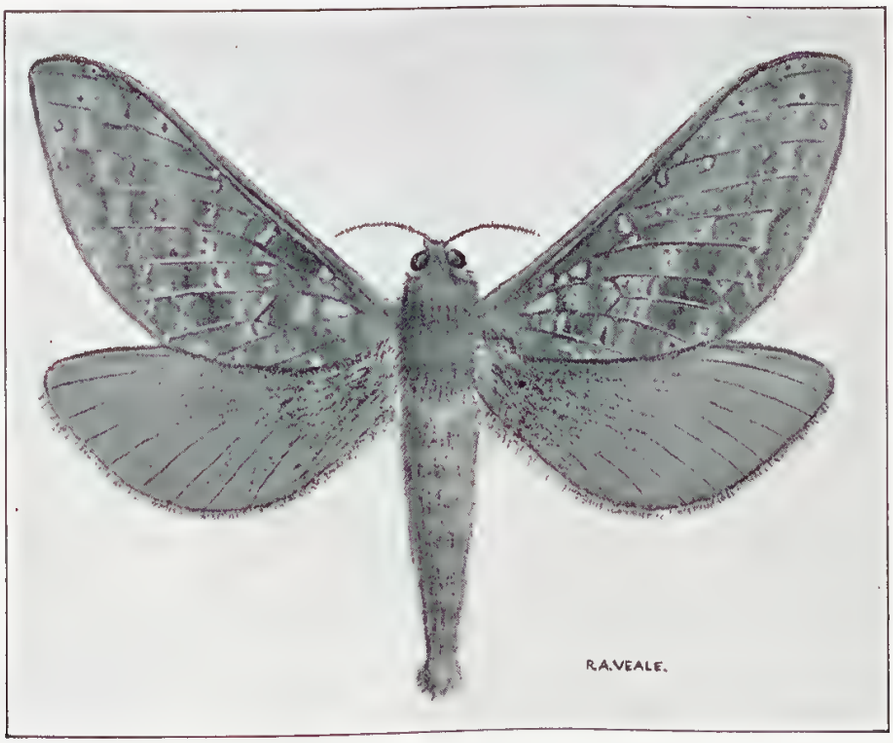

Fig. 78. *Oxycanus aurifex* sp. nov., type, a male, Dorrigo.

Loc. New South Wales: Dorrigo (R. J. Tillyard, ex Lower Collection, type, a male, I. 18864 in S. Aust. Mus.). 1 male.

The antennal pectinations are more developed than in *O. ballux*; it differs from *O. gelidus* in the form of the wings, in their sub-hyaline texture, and in the positions of the markings. The dull golden-yellow areas grouped about the base of the forewings should be distinctive.

OXYCANUS NAIAS sp. nov.

Fig. 30, 79.

♂ Antennae reddish-ochreous, short, pectinations short and stout, 1½; head and thorax reddish-brown, abdomen dark brown. Forewing uniformly reddish-brown with small brownish-black markings. Hindwings dark brown, concolorous with abdomen; apex, termen, and veins narrowly tinged with reddish-brown. Expanse 103 mm.

Fig. 79. *Oxycanus naias* sp. nov., type, a male, Wentworth Falls.

Loc. New South Wales: Wentworth Falls 4 (April 3, 1915, type, a male, I. 18865 in S. Aust. Mus.); Armidale 5; Newcastle; Dorrigo. Queensland: Gympie. 8 males.

The eight specimens examined are variable in the degree of development of the markings. A second example from Wentworth Falls has a discoidal dark brown suffusion on the forewings and two rather large white-centred black spots between radio-median vein and base.

Fig. 80. *Oxycanus gelidus* sp. nov., type, a male, Armidale.

OXYCANUS GELIDUS sp. nov.

Fig. 31, 80.

♂ Antennae ochreous, short, pectinations short, stout, 1-1¼; head and thorax pale greyish-fawn, abdomen fawn. Forewings opaque, greyish-brown, due to a mixture of dark brown and creamy-grey scales; a semi-circular area parallel to termen warm brown, with series of paired darker spots and a broad darker brown marginal band; traces of a series of transverse creamy-white spots in outer portion of wing, and two larger ones, one at r-m vein and another half-way from there to base. Hindwings very pale chocolate-brown. Expanse 94 mm.

Loc. New South Wales: Armidale 5 (May, 1928, type, a male, I. 18866 in S. Aust. Mus.); Dorrigo; 3 males.

Allied to *O. ballux*, from which it differs in the broader, more closely-set wing scales, which give the wings a dull frosted appearance, and in the subfalcate apices to forewings.

OXYCANUS GOLDFINCHI sp. nov.

Fig. 32, 81.

♂ Antennae short, slender, weakly bipectinate, 1; head and thorax warm brown, abdomen dark chocolate-brown, apex with a paler greyish-brown tuft.

Fig. 81. *Oxycanus golfinchi* sp. nov., type, a male, Wentworth Falls.

Forewings with apex subfalcate, ochreous-brown, with traces of dark brown suffusions at and near apex; a semi-lunate silvery-white mark at r-m vein, and another small circular one more than half-way to base. Hindwings dark chocolate-brown, slightly paler at base and near apex. Expanse 106 mm.

Loc. New South Wales: Wentworth Falls 5 (May 1, 1927, G. M. Goldfinch, type a male, I. 18867 in S. Aust. Mus.); Normanhurst 5; Killara 5. 4 males.

This species was taken at Wentworth Falls on the same date as an example of *O. naias*, from which it is distinct in the form of the antennae and in the form, colour, and markings of the wings. Examples vary from 86 to 118 mm. in expanse, and the colour of the forewings ranges from a warm brown to a dark chocolate-brown, with mottled markings; the new-moon-shaped white mark on the forewings is a rather constant feature. The slightly concave anterior portion of the margin to the tegumen is characteristic. This was not considered sufficiently marked to warrant its displacement from what otherwise appears to be its natural place in the key.

OXYCANUS ROSACEUS sp. nov.

Fig. 33, 82-83.

♂ Antennae ochreous, moderately long, pectinations short, $1\frac{1}{2}$; head and thorax ochreous-brown, abdomen pink, apex with an ochreous tinge. Forewings ochreous-brown, basal part of costa darker; a bright ochreous suffusion in basal fourth, not extending to base; a series of obscure greyish-brown spots, the larger ones with a few silvery-white scales, forming ocelli; an angled greyish-brown suffusion from near apex to R_5. Hindwings ochreous-brown; veins and margins reddish-ochreous, base densely clothed with bright pink down. Expanse 75 mm.

♀ Antennae ochreous, short, pectinations almost obsolete, $\frac{1}{4}$; head, thorax, anterior, and median legs, and apex of abdomen pale ochreous-brown; base of abdomen bright salmon-pink. Forewings subhyaline, uniformly pale ochreous-brown. Hindwings hyaline, greyish-brown, costal margin, base of wing, and veins pink; a large circular dark greyish-brown suffusion near base. Expanse 113 mm.

Loc. Victoria: Moe 4, 5 (April 29, 1922, C. G. L. Gooding, type, a male, and allotype female, I. 18868 in S. Aust. Mus.). New South Wales: Mt. Kosciusko (5,000 ft.) 3. 10 males, 3 females.

One female specimen taken on the same evening as the type pair is smaller, 97 mm. in expanse, and has the forewings marked as in the male, the hindwings, however, are the same as in the allotype. A third example resembles the first in size and in the absence of markings on the forewings.

The male genitalia have a well-marked median spine on the tegumen and a moderate anterior (suspensorial) spine which is bent outwards at the apex, but it is neither so long nor so well hooked as in the next species, *O. hamatus*, from which it is otherwise quite distinct in colour and markings.

Fig. 82–83. *Oxycanus rosaceus* sp. nov. 82, type, a male, Moe; 83, allotype female, Moe.

OXYCANUS HAMATUS sp. nov.

Fig. 34, 84-85.

♂ Antennae pale reddish-ochreous, pectinations slender, 2-2½, a short basal projection to each segment. Head and thorax dark reddish-ochreous, abdomen paler. Forewings bright reddish-ochreous, costal margin narrowly darker; an ocellus at r-m vein dull white ringed with black; traces of dark brown spots ar-

ranged in three transverse series; a larger obscure spot near inner margin, at one-half. Hindwings bright ochreous, basal hairs largely restricted to costal margin. Expanse 87 mm.

Loc. New South Wales: Jervis Bay 5, 6 (June 3, 1918, type, a male, I. 18869 in S. Aust. Mus.). 2 males.

A paratype example (fig. 85) in Dr. A. J. Turner's collection is smaller (75 mm. in expanse), and lacks the small obscure dark markings on the forewings; the ocellus is silvery-white, and there is a trace of another smaller one half-way

Fig. 84–85. *Oxycanus hamatus* sp. nov. 84, type, a male, Jervis Bay; 85, male, Jervis Bay.

to the base of the wing. The long hook-like suspensorial process is a characteristic of the genitalia of the species.

In genital characters this species is nearest to *O. stellans* and to *O. rosaceus;* from the former it differs in the prolongation of the anterior process of the tegumen. The suspensorial process is much longer than in *O. rosaceus,* and the apex is much more strongly recurved. From *O. rosaceus* it also differs markedly in the absence of the rose-coloured suffusion at base of wings; the rather uniform reddish-ochreous colour of the body and wings is distinctive.

OXYCANUS STELLANS sp. nov.

Fig. 35, 86-88.

♂ Antennae ochreous, pectinations short, 1-1½, stout, a well-marked pair of basal processes to each segment; head and thorax brown; abdomen rose-pink, densely clothed with pink down. Forewings greyish-brown, costal third with a bright reddish-ochreous suffusion, costa from base almost to one-half dark brown, discal region with many silvery-white spots, margined with dark brown, the

outer ones arranged in two irregular series parallel to termen; a series of small terminal silvery spots; ciliae reddish-ochreous. Hindwings pale reddish-ochreous, base rose-pink. Wings beneath with base rose-pink, concolorous with abdomen. Expanse 76 mm.

Fig. 86–88. *Oxycanus stellans* sp. nov. 86, male, variety, Wandin; 87, type, a male, Cockatoo; 88, allotype female, Cockatoo.

♀ Antennae ochreous, pectinations almost obsolete, head and thorax pale fawn, abdomen ochreous. Forewings pale fawn, with traces of an obscure white fascia from base to about ⅓ termen; a few brown subcostal markings near apex. Hindwings pale ochreous, slightly brighter near base. Wings below bright ochreous, near termen of forewing obscurely darkened. Expanse 99 mm.

Loc. Victoria: Cockatoo 5 (May 5, 1924, G. F. Hill, type, a male, and allotype female, I. 18870 in S. Aust. Mus.); Wandin 5; Croydon 4; Beaconsfield 4. 11 males, 2 females.

This is one of the most pleasing of the new species of *Oxycanus*. Although the type pair do not resemble each other very closely the fact that Mr. Hill took them both on the same evening and at the same place seems sufficient justification for their association. The male genitalia bear a single posterior process on the tegumen, which does not appear to rise from a lobe or eminence, and is remote from the median spine; it is thus distinct from *O. sordidus*, from which it is also quite distinct in markings and general appearance. Some specimens have the silvery-white markings reduced in size and the forewings with an ochreous suffusion, as in the example shown in fig. 86.

OXYCANUS SPADIX sp. nov.

Fig. 36, 89.

♂ Antennae bright yellow, long, pectinations short, slender, set rather widely apart, 1; head and thorax reddish-brown, abdomen fawn. Forewings reddish-brown with costa, at base, and a rather broad subterminal area, dark brown with series of black spots surrounded by reddish-brown, a few of them with minute reddish-brown centres; a pair of small dull white spots, margined with dark brown, at r-m vein. Hindwings dark fawn, costa narrowly ochreous-brown; a small tuft of dull creamy-white hairs, tinged with pink, along posterior margin. Expanse 66 mm.

Fig. 89. *Oxycanus spadix* sp. nov., type, a male, Blackheath.

Loc. New South Wales: Blackheath 2, 12 (February 15th, 1922, E. W. Ferguson, type, a male, I. 18871 in S. Aust. Mus.); 2 males.

In the form of the tegumen this species shows a close relationship with *O. stellans,* from which it is easily distinguishable by the form of the wings and the entirely different scheme of markings and colour pattern. In the second example the paired white spots at r-m vein of the forewing are larger, and confluent.

OXYCANUS LOESUS sp. nov.

Fig. 37, 90-91.

♂ Antennae ochreous, moderately long, pectinations $2\frac{1}{2}$-3; base of each segment with a well-marked protuberance bearing tufts of hairs; head, thorax, and legs reddish-ochreous, abdomen slightly paler, with a salmon-pink tinge. Fore-

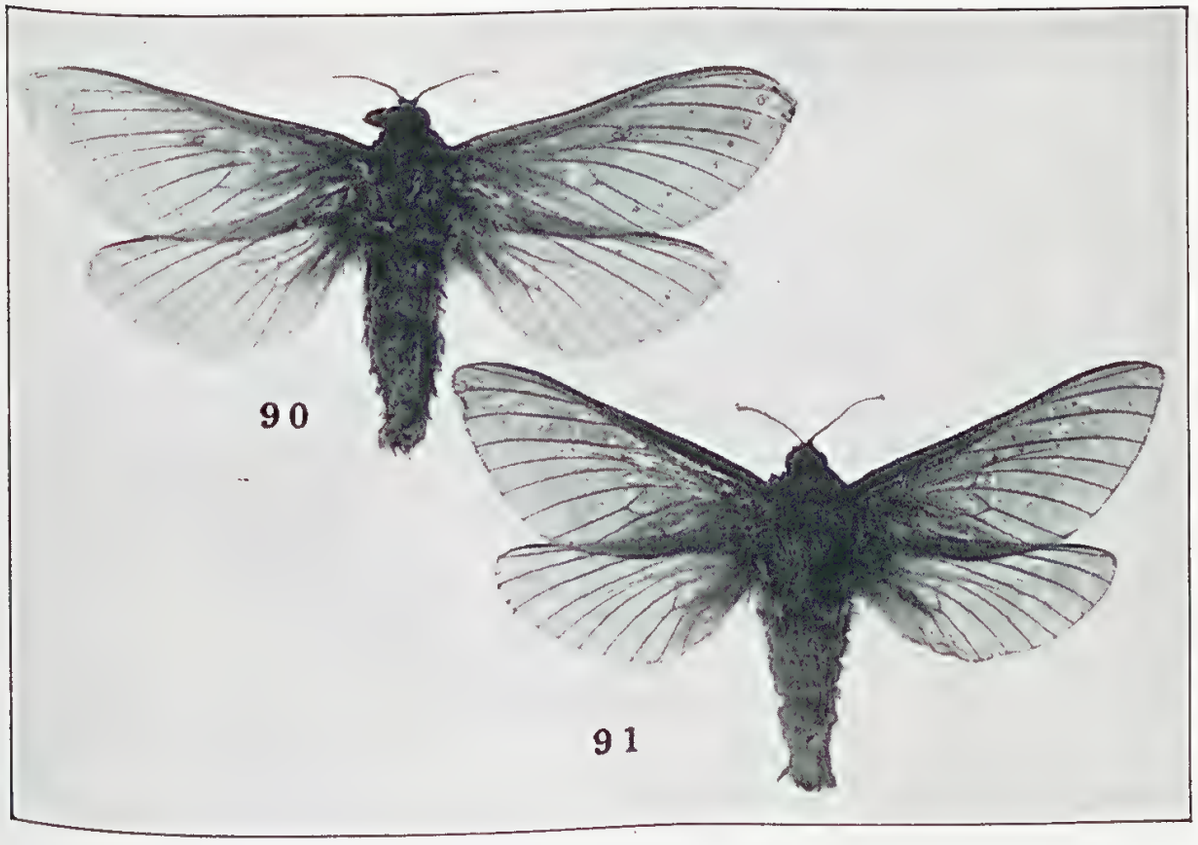

Fig. 90–91. *Oxycanus loesus* sp. nov. 90, type, a male, Manly; 91, male, Moe.

wings uniformly bright reddish-ochreous; a subterminal series of small greyish-brown spots from near apex to near inner margin, the subapical ones with yellow centres; a pair of yellow-centred spots at r-m vein and two others half-way from there to apex. Hindwings pale reddish-ochreous, at base salmon-pink; ciliae reddish-ochreous. Expanse 80 mm.

Loc. New South Wales: Manly 3 (March 28, 1911, type, a male, I. 18872 in S. Aust. Mus.); Killara 5; Gordon 4; Sydney; Woodford 5; Hornsby 5. Victoria; Moe 5; Ararat; Croydon 5. 20 males.

The second example figured (fig. 91) is from Moe, and was taken in April. It has the costa dark brown at base and the subterminal series of spots are absent. Two examples from New South Wales (Hornsby and Killara) have the hindwings suffused with dark grey, except at base, and another aberrant example from Sydney has the forewing pattern repeated on the hindwing. In the structure of the tegumen this species is nearest to *O. stellans,* from which it differs in the short distance separating the median and posterior spines.

OXYCANUS OCCIDENTALIS sp. nov.

Fig. 38, 92-93.

♂ Antennae yellow, pectinations 3, slender, a pair of small elevations bearing hairs near base of each segment; head and thorax greyish-brown, abdomen slightly paler. Forewings greyish-brown; a series of well-marked silvery-white

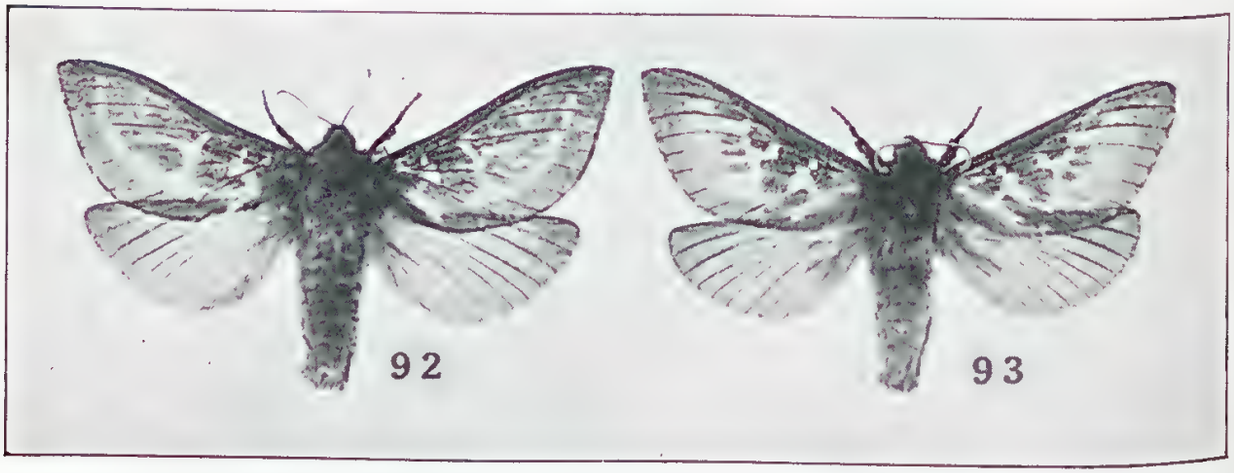

Fig. 92–93. *Oxycanus occidentalis* sp. nov. 92, type, a male, Denmark, W. Aust.; 93, male, Denmark, W. Aust.

marks in the discal region and a series of obscure yellowish-white marks along termen. Hindwings greyish-brown, base moderately clothed with hairs which have a slightly more ochreous tinge. Expanse 61 mm.

Loc. Western Australia: Denmark 4 (April 21, 1926, W. B. Barnard, type, a male, I. 18873 in S. Aust. Mus.); Collie 5, 7; Lennox 5; Cunderdin; Mundaring. 11 males.

The female of this species has not yet been discovered. It is just possible that the example associated, in this paper, with the next species may actually belong to this one.

The males are rather constantly marked, for the genus; in a few specimens the silvery-white markings are enlarged. The male genitalia have the tegumen armed with a large median and four posterior spines. The form of the tegumen with its four large posterior spines marks this species off from *O. niphadias* and *O. goodingi,* to which it bears a marked superficial resemblance.

There is a single broken and undescribed specimen of a species from Pinnaroo, S. Australia, in our collection, which possesses a tegumen somewhat of the type present in this species.

OXYCANUS POETICUS sp. nov.

Fig. 39, 94-96.

♂ Antennae reddish-ochreous, short, slender, pectinations reduced ($\frac{1}{2}$-$\frac{3}{4}$), head, thorax, and anterior and median legs, greyish-fawn; apex of abdomen

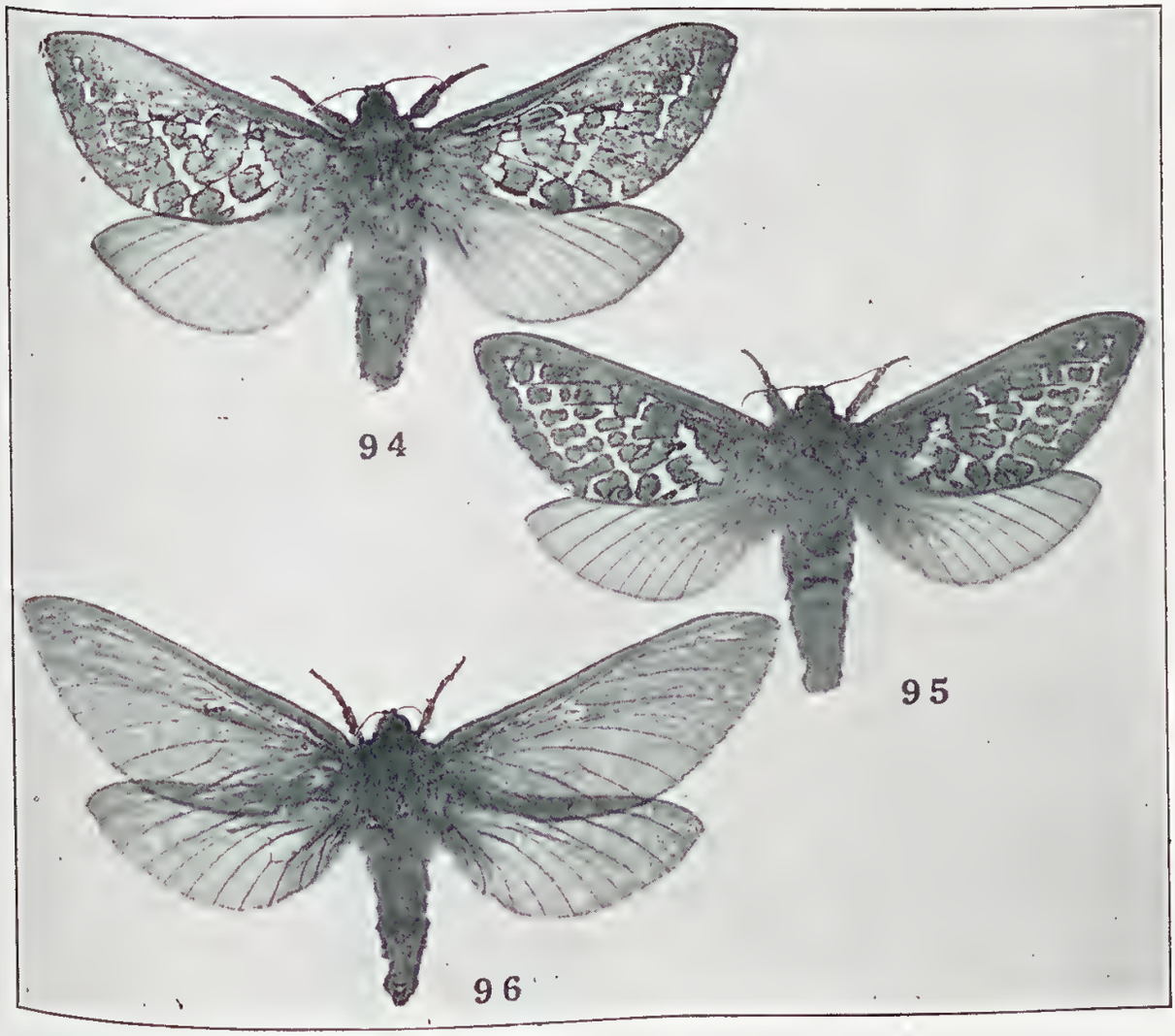

Fig. 94–96. *Oxycanus poeticus* sp. nov. 94, male, Denmark, W. Aust.; 95, type, a male, Denmark, W. Aust.; 96, allotype female, Denmark, W. Aust.

paler; base of abdomen salmon-pink. Forewings brown, costal margin from base to one-half darker; an ochreous subcostal suffusion from one-half to near apex; discal region brownish-ochreous; a large series of silvery-fawn irregular markings, outlined with dark brown; ciliae pale brown. Hindwings pale reddish-ochreous, obscurely pale brown near apex, veins narrowly and base broadly bright salmon-pink; ciliae concolorous. Expanse 82 mm.

♀ Antennae ochreous, very short, pectinations obsolete; head, thorax, and legs greyish-fawn, apex of abdomen a little paler, base of abdomen pale brownish-ochreous. Forewings hyaline, pale fawn with obscure brown suffusions visible at certain angles only; a dull white spot at r-m vein obscurely margined with brown. Hindwings hyaline, pale fawn. Expanse 92 mm.

Loc. Western Australia: Denmark 4 (April 21, 1926, W. B. Barnard, type, a male, and allotype female, April 18, 1926, I. 18874 in S. Aust. Mus.). 2 males, 1 female.

The paratype male (fig. 94) is in the collection of Mr. W. B. Barnard. This species was taken on the same day and place as the next one. This led at first to the conclusion that they were the same, but a more critical examination of the male genitalia and a consideration of the outstanding differences in the wing pattern and colour has yielded convincing evidence of their distinctness. The wings in this species are somewhat more ample, and the apex of forewing not quite so acute. It has a superficial resemblance to the Eastern Australian *O. stellans*, from which it differs in the positions of the markings, in the absence of the rose-pink tinge to hindwings and abdomen, and in the form of the tegumen.

OXYCANUS PROMISCUUS sp. nov.

Fig. 40, 97-98.

♂ Antennae bright ochreous, pectinations short ($\frac{3}{4}$-1); head, thorax, abdomen, and legs bright reddish-ochreous. Forewings bright reddish-ochreous, costal margin slightly darker near base; a marked silvery-white, black-margined spot at r-m vein; traces of two subterminal series of brownish-black spots, three with white centres; a terminal series of obscure dark brown semi-lunate marks; two other dark spots obscurely centred with white scales. Hindwings ochreous, three obscure dark spots near apex. Expanse 76 mm.

Loc. Western Australia: Denmark 4 (April 21, 1926, W. B. Barnard, type, a male, I. 18775 in S. Aust. Mus.). 2 males.

It is possible that the female associated with *O. poeticus* may belong either to this species or to *O. occidentalis*. The colour of the legs, head, and thorax, and

obscure traces of marks visible in some angles of light, do not suggest this species. The paratype male (fig. 97) is in the collection of Mr. W. B. Barnard.

The tegumen of the male genitalia possesses an external marginal spine which is absent in *O. poeticus;* the markings of the forewings are also very differ-

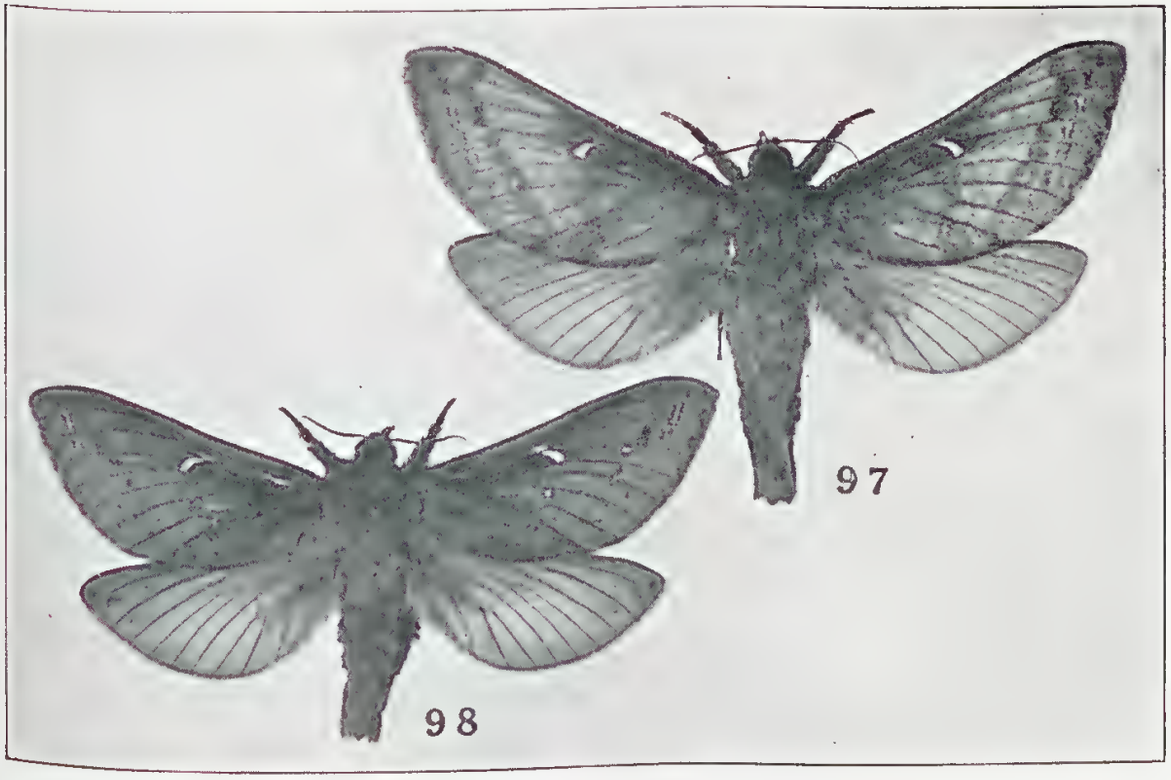

Fig. 97–98. *Oxycanus promiscuus* sp. nov. 97, male, Denmark, W. Aust.; 98, type, a male, Denmark, W. Aust.

ent to those of that species. It is remarkable that three species, so distinct from each other, should fly at Denmark during the same period, and probably indicates that in the districts of South Western Australia, with heavy rainfall, we have a rich Hepialid province, the fauna of which has only just been touched upon.

OXYCANUS SORDIDUS (Herrich-Schaeffer).

Fig. 41, 99-101.

Epiolus sordidus Herrich-Schaeffer, Lep. Exot., 1853, pl. xi, f. 49 (male).
Abantiades sordidus Herrich-Schaeffer, *l.c.* 1855, p. 5.
Oxycanus rufescens Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1575 (male).
Pielus ? sordidus Walker, l.c. vii, 1856, p. 1578.
Pielus invarius Walker, *l.c.* xxxii, 1865, p. 599 (female).
Porina rufescens Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1122.
nec *Porina rufescens* Pfitzner and Gaede, Seitz Macrolep., x, 1933, p. 839, pl. 76e.

♂ Antennae yellow, pectinations moderate, $2\frac{1}{2}$; head and thorax dark brown, abdomen pale red, except at apex. Forewings brown, with costa narrowly darker from base to $\frac{1}{2}$; traces of darker spots surrounded by diffuse areas of light brown scales forming two transverse series; obscure traces of a dark spot at r-m vein, more pronounced in other examples. Hindwings dull brown, costa and veins narrowly reddish-ochreous, base densely clothed with red down. Expense 74 mm.

♀ Antennae yellow, obsoletely bipectinate; head, thorax, and apex of abdo-

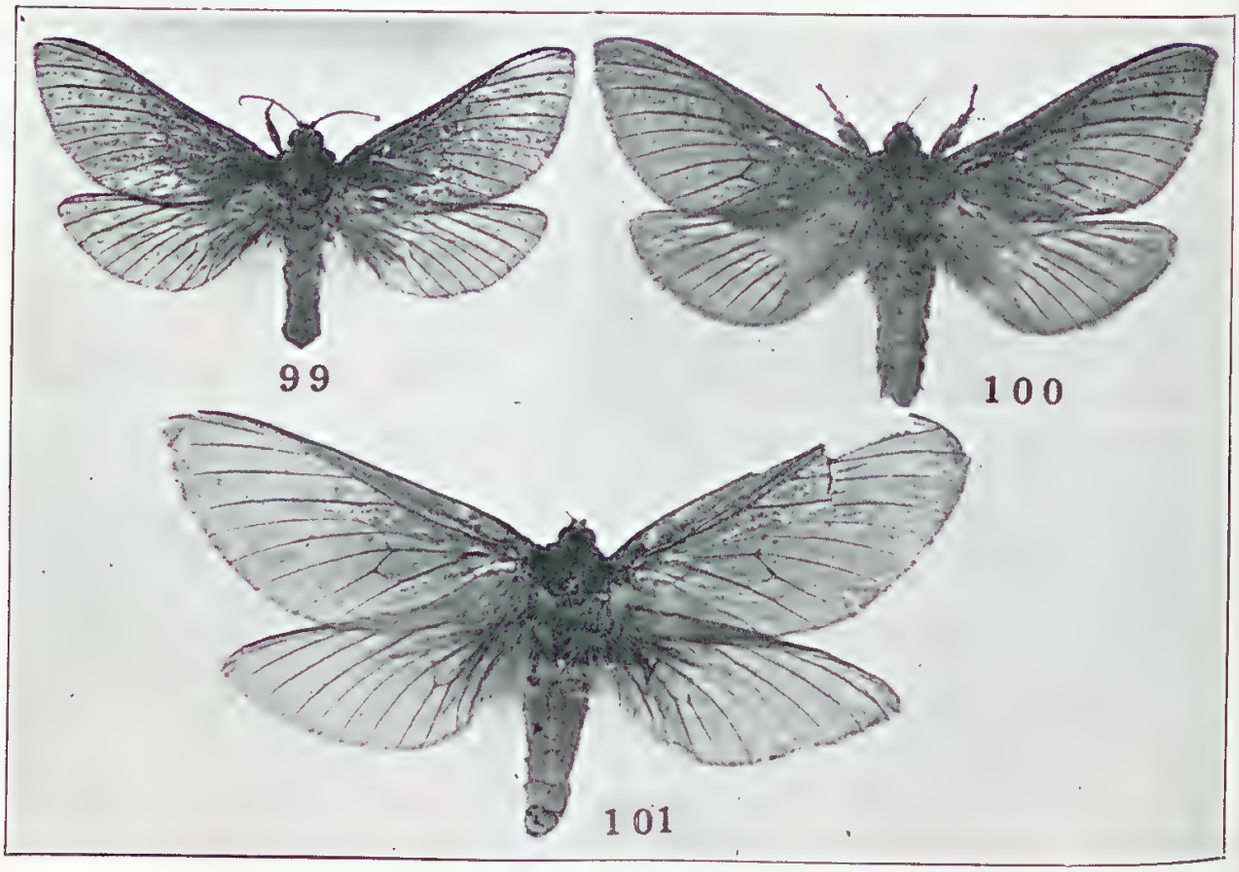

Fig. 99–101. *Oxycanus sordidus* (Herrich-Schaeffer). 99, male, Tasmania (type of *rufescens* Walker, in British Museum Collection); 100, novotype, a male, Snug River; 101, female Tasmania (type of *invarius* Walker, in British Museum Collection).

men pale fawn, base of abdomen with pink-tinged hairs. Forewings subhyaline, pale yellowish-fawn, with traces of two or more brown spots in outer portion of wing, between veins R_3 and R_5. Hindwings dull fawn, with base sparsely clothed with pink-tinged hairs. Expanse 101 mm.

Loc. Tasmania: Snug River 5 (May 1, 1927, novotype, a male, I. 18876 in S. Aust. Mus.); Eagle Hawk Neck 4; Hobart; Launceston. Victoria: Gisborne 5; Moe 4; Wandin; Beaconsfield 4; Belgrave; Croydon 5. New South Wales: Asquith 3; Wentworth Falls 4; Woodford 5; Hornsby 5; Sydney 5; Manly 6. 23 males, 1 female.

It is difficult to avoid the conclusion that Herrich-Schaeffer's species is the same as *O. rufescens* Walker from Tasmania. The colours and markings on the figure in his plate agree rather closely with some examples of it, and the venation, as drawn on the plate, is definitely that of an *Oxycanus*. The type is apparently no longer in existence; the specimen described above, from Tasmania, has therefore been selected as novotype, and Snug River is nominated as the type locality. *O. rufescens* Walker is a direct synonym. Walker's specimen which has been figured (fig. 99) was taken by Morton Allport, who collected chiefly near Hobart.

The hindwings are usually dull brown, with pink or pale red at the base. In mainland examples the ground colour of the wings is lighter and the forewings bear traces of small, white-centred spots and marks. Some specimens from New South Wales have these markings well developed, and the ground colour tends to become reddish-ochreous. The tegumen of the male genitalia remains constant and serves to distinguish such pale-coloured specimens from those of *O. loesus*, which may resemble them.

The only female specimen in our series has been described; it is from Victoria (I. 18877 in S. Aust. Mus.), and agrees closely with Walker's *Pielus invarius*, which is the female of *O. sordidus*.

OXYCANUS NUPTIALIS sp. nov.

Fig. 44, 102-103.

♂ Antennae ochreous, short, pectinations weak (1½-2), head and thorax dull greyish-brown, abdomen with apical half pale brown, base salmon-pink, and densely clothed. Forewings rather broad, hyaline, pale brownish-fawn with darker greyish-brown markings; costa greyish-brown, a white fascia from base almost to termen, at one half; three transverse series of conjoined spots and traces of a terminal series of dull brown spots between the veins. Hindwings hyaline, dull greyish-brown, base tinged with salmon-pink; ciliae greyish-brown. Expanse 64 mm.

♀ Antennae reddish-ochreous, very short, pectinations 1; head, thorax, and legs dull fawn, abdomen slightly paler, base of abdomen with a slightly ochreous tinge. Forewings hyaline, pale fawn with traces of darker grey markings, some with white centres, as in male; in addition five large silvery-white spots margined with grey; a well-marked series of small brown terminal spots between the veins, from apex to inner margin; ciliae pale brown. Hindwings hyaline, pale fawn; ciliae pale brown. Expanse 68 mm.

Loc. New South Wales: Mount Kosciusko, 5,000-6,000 ft., 3 (March, 1889, R. Helms, type, a male and allotype female, I. 18878 in S. Aust. Mus.). 1 male, 1 female.

The male was taken at 5,000 feet, and the female a 1,000 feet higher up on Mt. Kosciusko. The male genitalia have not been dissected from the type specimen, but sufficient may be seen, without removal, to place it satisfactorily in the

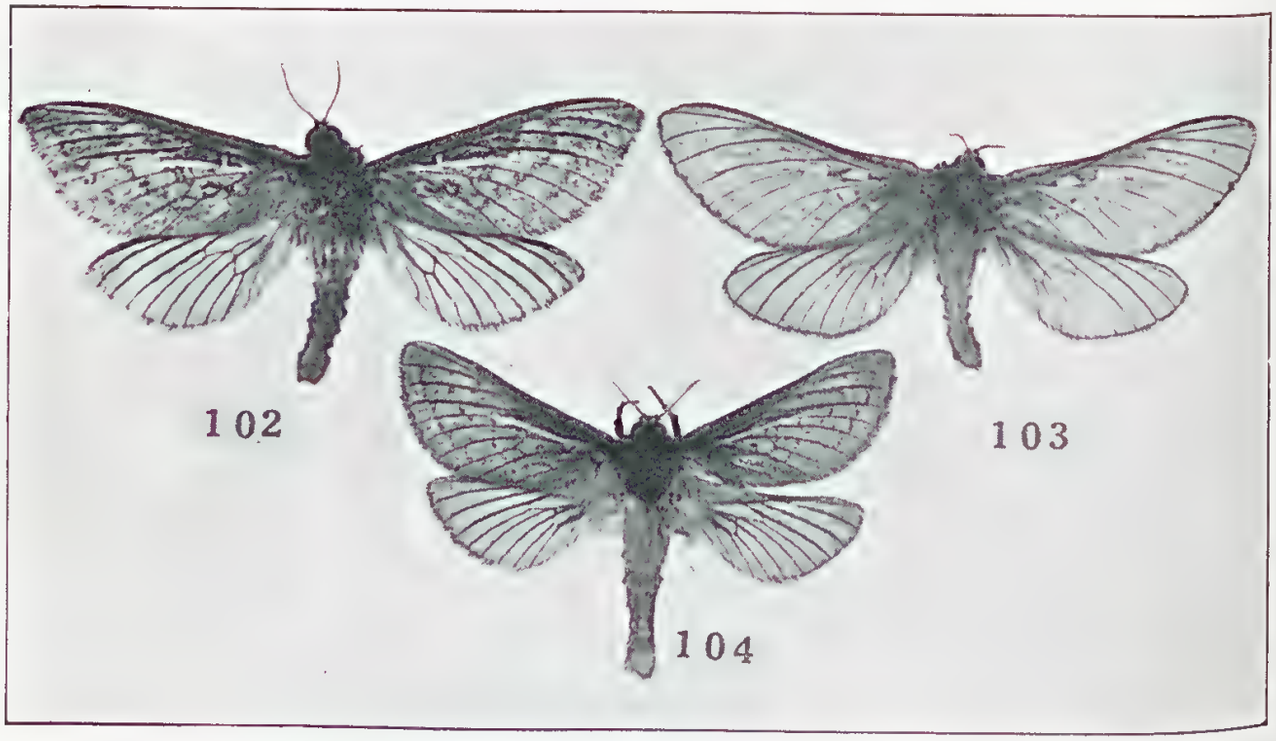

Fig. 102–104. 102–103 *Oxycanus nuptialis* sp. nov. 102, type, a male, Mt. Kosciusko, 5,000 ft.; 103, allotype female, Mt. Kosciusko, 6,000 ft. 104. *Oxycanus incanus* sp. nov., type, a male, Jervis Bay.

key. It is a rather distinctive species characterized by its hyaline, and rather sparsely scaled wings. It is related to the next species, from which it may be distinguished by its somewhat broader, hyaline wings and less conspicuously pectinated antennae.

OXYCANUS INCANUS sp. nov.

Fig. 42, 104.

♂ Antennae yellow, long, pectinations 3; head and thorax dark brown, abdomen at apex pale brown, base pale pink. Forewings pale brown, costa at base darker, with two transverse series of small dark brown spots, some with traces of greyish-white centres; a few other small spots, a narrow white, longitudinal fascia from base to r-m vein. Hindwings subhyaline, rather sparsely clothed with narrow, brown, hair-like scales, base narrowly clothed with pink

pubescence. Wings beneath dull brown with base narrowly rose-pink. Expanse 55 mm.

Loc. New South Wales: Jervis Bay (June 3, 1918, type, a male, I. 18879 in S. Aust. Mus.). 1 male.

This species resembles *O. nuptialis* in colour and markings, and in the general form of the genitalia, but it differs in the shape and texture of the wings, and in the antennae, which have pectinations almost twice as long as in that species.

Fig. 105–107. *Oxycanus barnardi* sp. nov. 105, male, Toowoomba; 106, type, a male, Toowoomba; 107, allotype female, Toowoomba.

OXYCANUS BARNARDI sp. nov.

Fig. 43, 105-107.

♂ Antennae dull yellow, long, pectinations ample, 5; head and thorax greyish-fawn, abdomen yellowish-fawn. Forewings greyish-fawn with faint pale yellow rings around dark fawn spots. Hindwings pale yellowish-fawn, apex slightly darker; base densely clothed with yellowish-fawn hairs. Expanse 74 mm.

♀ Antennae pale yellow, moderate, pectinations 1-1¼; head, thorax, and abdomen pale greyish-fawn, abdomen at base slightly yellowish-tinged. Forewings pale greyish-fawn with faint traces of markings, as in male. Hindwings pale greyish-fawn, at base clothed with paler hairs having a yellow tinge. Expanse 89 mm.

Loc. Queensland: Toowoomba 5, 6 (June 4, 1927, W. B. Barnard, type, a male, and allotype female, June 6, 1927, I. 18880 in S. Aust. Mus.); Blackbutt; 8 males, 2 females.

Some male examples have the markings on forewings obsolete, except for a faint yellowish tinge along veins R_1 and R_2 near apex; in such specimens the forewings may be dull greyish-brown, darker at base than at apex (fig. 105). The margin of tegumen of the male genitalia is strongly produced, medially, in a rounded lobe, which is not armed with spines. The species is not closely related to any other; in wing pattern it is somewhat allied to the paler examples of *O. silvanus,* in which, however, the tegumen is of entirely different character.

OXYCANUS NIPHADIAS (Meyrick).

Fig. 45, 108-109.

Porina niphadias Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1122.
Porina niphadias Quail, Trans. Ent. Soc. Lond., 1900, p. 421.

♂ Antennae pale reddish-ochreous, short, pectinations long, slender, 5; head and thorax dark brown, abdomen pale fawn. Forewings dull greyish-brown with a slight reddish-ochreous tinge near apex of costa; a series of dull white spots arranged in a triangle on wing and traces of a single longitudinal one parallel to 1A. Hindwings greyish-brown, at base paler and yellowish-tinged. Expanse 58 mm.

♀ Antennae yellow, short, pectinations short, 1; head, thorax, and abdomen pale fawn. Forewings subhyaline; uniformly pale fawn, a few white scales at r-m vein. Hindwings subhyaline, pale fawn, at base yellowish-tinged, and clothed with dense fine hairs. Expanse 78 mm.

Loc. South Australia: Balhannah 5; Blackwood 4, 5 (allotype female, May, E. Ashby, I. 18882 in S. Aust. Mus.). 28 males, 3 females.

The pair figured and described are from Blackwood, in May. This species which, so far as known, is confined to the Mount Lofty Range in South Australia, has been wrongly attributed by Quail to Patagonia!

Meyrick's type was from Balhannah, not "Mt. Lofty", as indicated in the original description. It was taken by Mr. E. Guest, together with another ex-

ample which is now in the South Australian Museum (I. 18883). Guest's notebook yields the following remarks:

"May 7, 1881 . . . . two specimens . . . . taken by me at Balhannah. It is

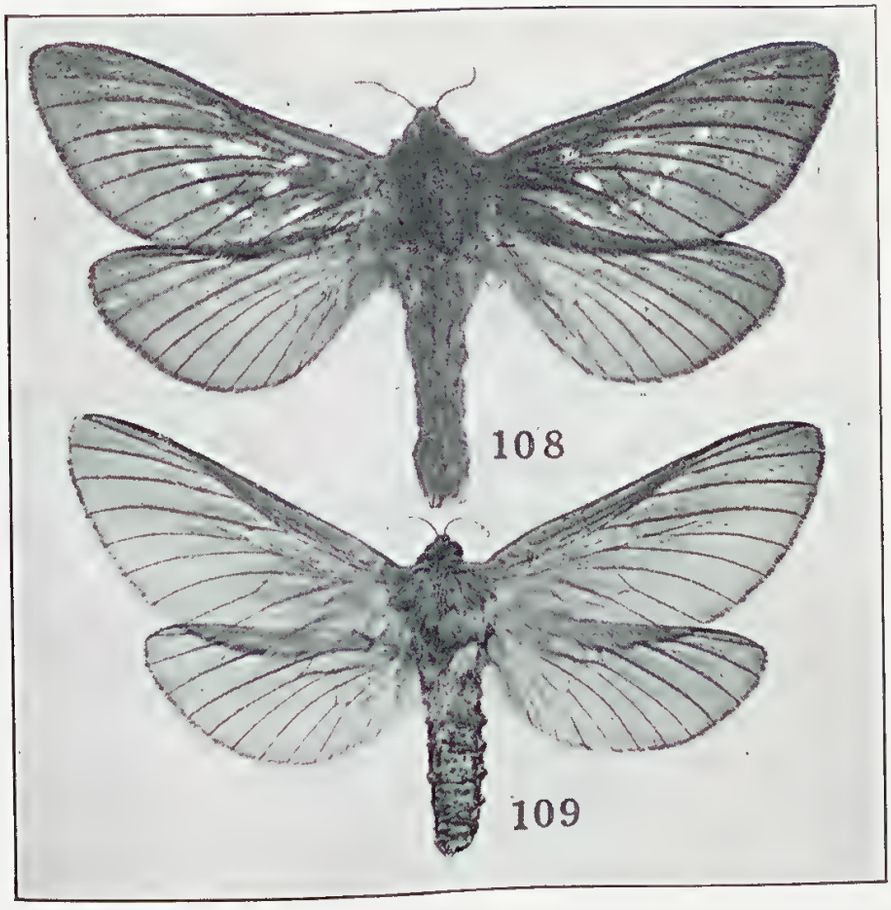

Fig. 108–109. *Oxycanus niphadias* (Meyrick). 108, male, Blackwood; 109, allotype female, Blackwood.

either rare or of retired habits, and I could never find the larva. It is a late autumn insect, being on the wing in April and May."

Mr. E. Ashby captures a few specimens each year. They come to lights on one cold wet evening in late April or early May. The females are seldom seen.

OXYCANUS GOODINGI sp. nov.

Fig. 46, 110-111.

♂ Antennae bright yellow, long, pectinations slender, moderately long, 3; base of each segment with a pair of conspicuous tufts; head and thorax dark greyish-brown, abdomen paler, with apex light greyish-brown. Forewings grey-

ish-brown, costa narrowly darker from base to ⅔rds; two transverse series of spots in outer half of wing, formed of sparsely set silvery-white scales; a conspicuous sub-rectangular sub-marginal area of white scales along hind margin; and several other white spots between r-m vein and base. Hindwings rather uniformly greyish-brown. Expanse 70 mm.

♀ Antennae bright yellow, short, shortly bipectinate, ½; head, thorax, and apex of abdomen pale fawn, base of abdomen lighter. Forewings hyaline, rather uniformly pale fawn, without markings; costa narrowly dark fawn. Hindwings hyaline, pale fawn, base sparsely clothed with paler fawn hairs. Expanse 80 mm.

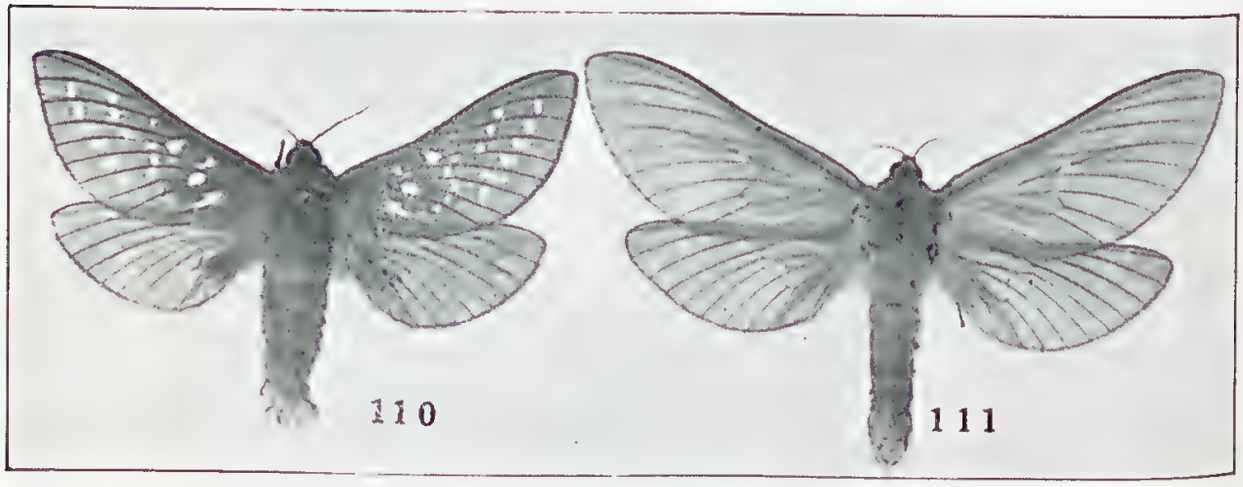

Fig. 110–111. *Oxycanus goodingi* sp. nov., 110, type, a male, Moe; 111, allotype female, Moe.

Loc. Victoria: Moe 4, 5 (April 29, 1922, C. G. L. Gooding; type, a male, and allotype female, I. 18884 in S. Aust. Mus.); Sale. 33 males, 27 females.

A large series, including the type pair, were taken at Moe by Mr. Gooding, on four nights, between April 20th and May 1st, 1922; it is otherwise exceedingly rare. The tegumen of the male (fig. 46) is very strongly developed, with a large median rounded process bearing small serrations upon its posterior margin; it is thus very distinct from *O. occidentalis* and *O. niphadias*, the only two species with which it might otherwise be confused.

OXYCANUS SIRPUS sp. nov.

Fig. 47, 112-113.

? Porina rufescens Pfitzner and Gaede, Seitz Macrolep., x, 1933, p. 839, fig. 76e (part).

♂ Antennae pale reddish-ochreous, long, pectinations short, stout, 1; head and thorax light brown, abdomen salmon-pink, apex tinged with reddish-ochre-

ous. Forewings pale reddish-ochreous, with greyish-brown markings and suffusions. Hindwings with apical half pale reddish-ochreous; base clothed with dense salmon-pink hairs. Expanse 96 mm.

♀ Antennae pale reddish-ochreous, relatively long, slender, pectinations obsolete; head and thorax pale fawn; abdomen creamy-yellow, at base pale salmon-

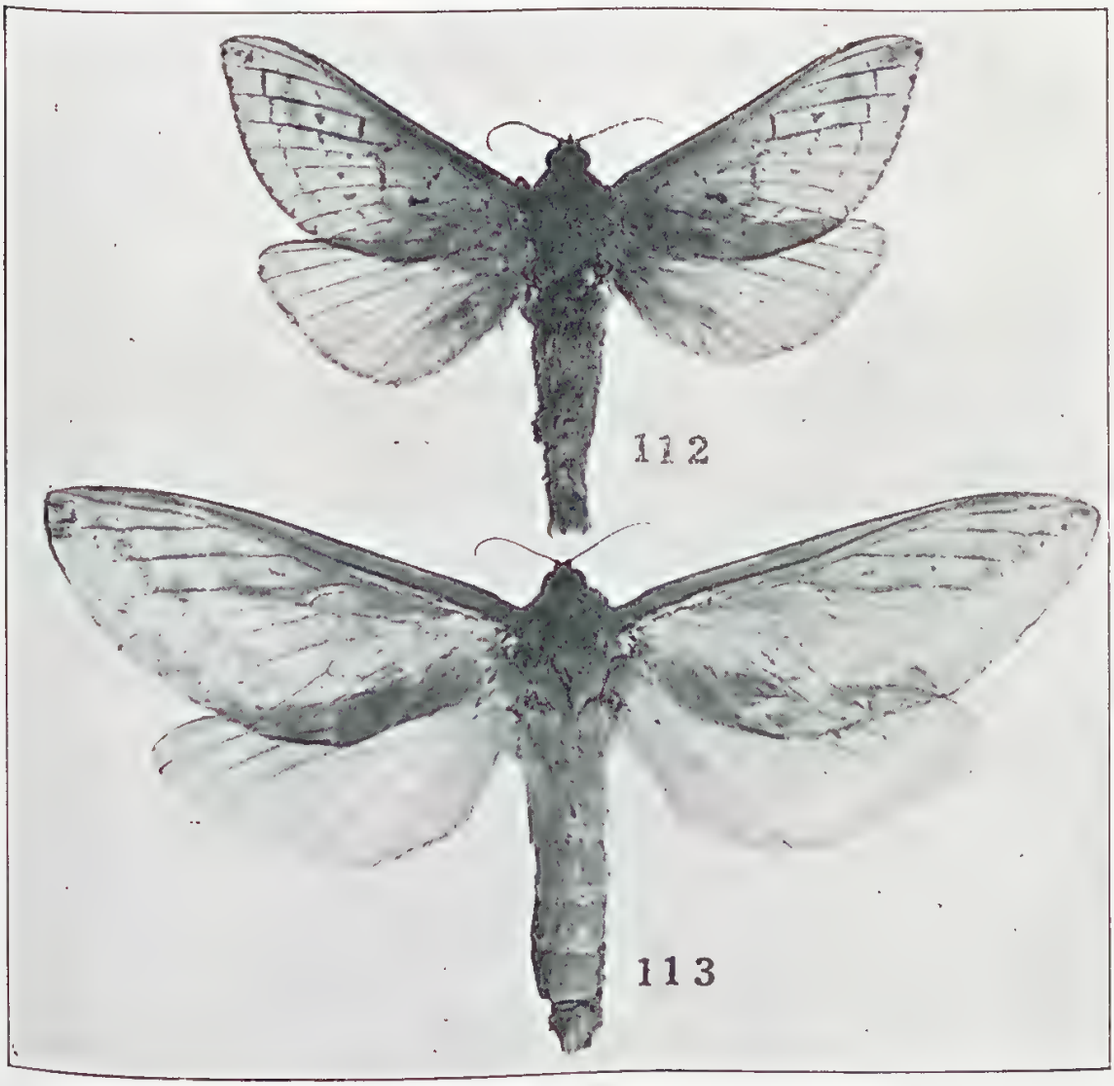

Fig. 112-113. *Oxycanus sirpus* sp. nov. 112, type, a male, Ferntree Gully; 113, allotype female, Ferntree Gully.

pink. Forewings hyaline, pale fawn, with large dull white suffusions surrounding pale greyish-brown marks, hindmargin broadly suffused with fawn. Hindwings subhyaline, rather uniformly pale creamy-yellow. Expanse 110 mm.

Loc. Victoria: Ferntree Gully 4, 5 (May 2, 1921, type, a male, and allotype female, I. 18885 in S. Aust. Mus.); Croydon 5; Beaconsfield 4; Moe 4; 7 males, 2 females.

This species is not closely allied to any of its congeners. It is variable in size; the smallest male examined is 62 mm. across the wings. The laterally expanded semi-circular margins to the tegumen of the male are quite distinctive, giving the appearance of a large serrated disc when viewed from beneath. In wing markings the species is nearest to some examples of *O. waterhousei*. Several examples have traces of two large white subcostal spots, as in that species. The example figured by Pfitzner and Gaede as *Porina rufescens* probably belongs to this species, but is smaller than the type.

OXYCANUS SUBVARIUS (Walker).

Fig. 48, 114-118.

Elhamma subvaria Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1562.
Oxycanus subvarius Walker, *l.c.* p. 1575.
Porina subvaria Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1123.

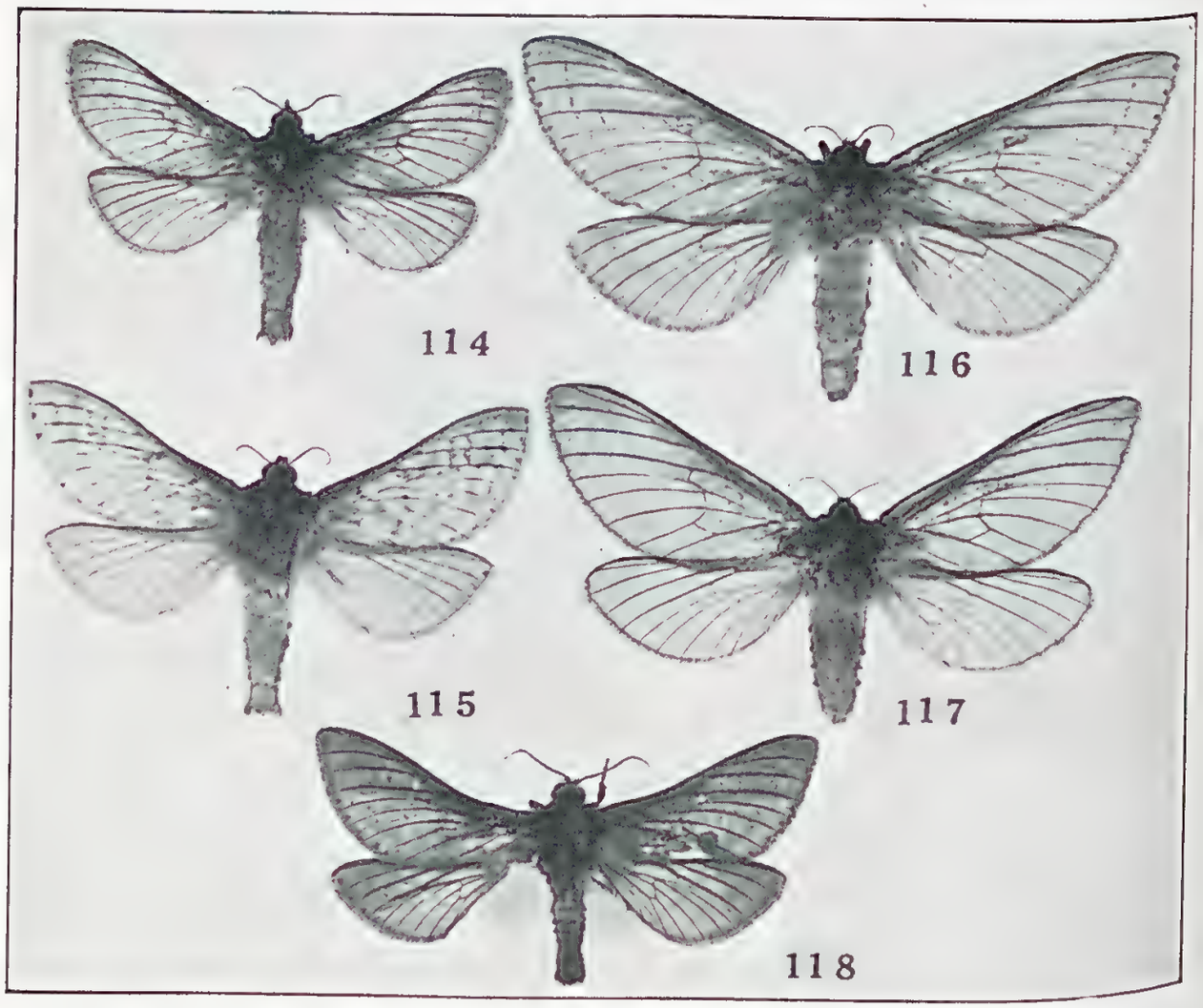

Fig. 114–118. *Oxycanus subvarius* (Walker). 114–115, males, Moe; 116–117, females, Moe; 118, type, a male, Tasmania (in British Museum Collection).

♂ Antennae reddish-ochreous, short, pectinations short, 1¼-1½; head and thorax dark brown, abdomen pale ochreous with a tinge of salmon-pink, at apex darkening to pale fawn. Forewings sub-hyaline, ochreous with darker greyish-brown markings, costal margin near base narrowly greyish-brown. Hindwings hyaline, grey with traces of greyish markings at base, costal veins narrowly and ciliae ochreous. Expanse 62 mm.

♀ Antennae yellow, short, pectinations short, ½; head and thorax fawn, basal half of abdomen pale ochreous, with a tinge of salmon-pink, apex pale fawn. Forewings subhyaline, pale grey, with faint darker grey spots surrounded by obscure pale ochreous. Hindwings hyaline, greyish-fawn, veins ochreous. Expanse 79 mm.

Loc. Tasmania: Ulverstone. Victoria: Moe 3, 4; Croydon 5, 6; Beaconsfield 3; Trafalgar 3; Yarragon 2. New South Wales: Austinmer 4. 54 males, 17 females.

The type, a male, has been figured; it is from "Van Diemen's Land", and is one of three presented to the British Museum by S. Walcott. The same three examples were apparently re-described, on p. 1575 of Walker's "List", as *Oxycanus subvarius*. The pair described above (fig. 115-116) are well-marked, many examples are smaller, somewhat darker, and almost devoid of markings (fig. 114, 116). The species is sometimes abundant in Eastern Victoria. Mr. C. G. L. Gooding has taken long series. In 1929 he wrote: "I managed to secure ninety examples of this Hepialid, and they are consistent with the fifty-four I am sending you". The tegumen of the male has a large anteriorly directed process, and the suspensorial process is only moderately developed and relatively straight.

OXYCANUS LAMNUS sp. nov.

Fig. 49, 119-120.

♂ Antennae reddish-ochreous, short, pectinations 1-1¼; head and thorax dark brown; abdomen, at base reddish-ochreous, at apex fawn. Forewings dull greyish-brown with slightly darker markings, surrounded by dusky ochreous suffusions. Hindwings subhyaline, pale grey, at veins obscurely reddish-ochreous. Expanse 60 mm.

♀ Antennae ochreous, short, with pectinations almost obsolete; head and thorax greyish-fawn, abdomen yellowish-fawn, becoming fawn at apex. Forewings subhyaline, greyish, with obscure dusky yellow areas surrounding grey spots and forming a series from costa at three-fourths to near hind margin at one-

half; traces of other marks near base. Hindwings pale grey, base narrowly clothed with yellowish-fawn hair. Expanse 76 mm.

Loc. New South Wales: Manly 5, 6 (May 31, 1907; type, a male, and allotype female, May 30, 1907, I. 18881 in S. Aust. Mus.); Clifton 4. 5 males, 4 females.

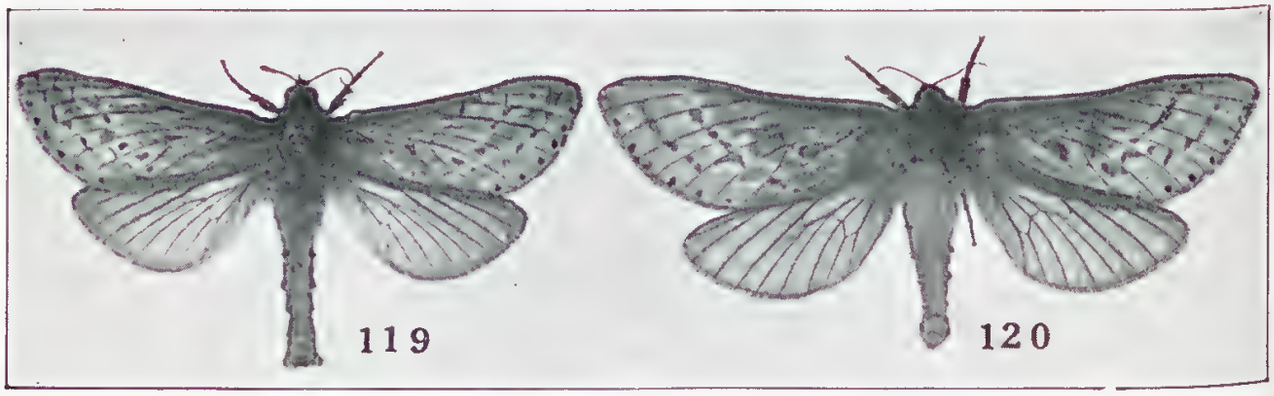

Fig. 119–120. *Oxycanus lamnus* sp. nov. 119, type, a male, Manly; 120, allotype female, Manly.

This species is closely related to the proceeding one, of which it may eventually prove to be the northern race. The genitalia of the male differ from *O. subvarius* in having the marginal process of tegumen much larger and the suspensorial spines produced and curved. The hind margin of the eighth sternite is evenly concave, whereas in the former species it is convex at the sides, with a slight median concavity. The wings differ in their greater opaqueness, and in the relative positions of the vague markings of forewings.

OXYCANUS SPHRAGIDIAS (Meyrick).

Fig. 50, 121.

Porina sphragidias Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1123.

♂ Antennae reddish-ochreous, pectinations obsolete, head and thorax above brown, beneath orange-brown, abdomen grey, at apex ochreous. Forewings chocolate-brown with ochreous markings, a black irregular mark near hind margin at base, and a broad white fascia from near base to termen. Hindwings pale chocolate-brown, base grey. Wings beneath dull chocolate-brown, with costal margins and an irregular terminal area orange. Expanse 53 mm.

Loc. Tasmania: Maitland; Launceston; Ulverstone. 15 males.

The male example figured is from Launceston. Some examples lack the white fascia of forewings, and are much darker in the forewings. The species is a rare one, and nothing is known of the life history. It is not close to any other

species of the genus, and further study may show that subgeneric separation is warranted. The long straight margin of the tegumen of the male genitalia, with its anteriorly projecting process, is distinctive.

Fig. 121. *Oxycanus sphragidias* (Meyrick), male, Launceston.

An aberrant specimen of what appears to be this species has been taken by D. C. Pearse, on Mount Wellington (May 25, 1934). It has the forewing bright reddish-ochreous; there is no white fascia. A somewhat similar example is under examination from Launceston; in this the forewings are bright reddish-brown.

OXYCANUS DETERMINATUS (Walker).

Fig. 51, 122-125.

Elhamma determinata Walker, List Lep. Ins. Brit. Mus., vii, 1856, p. 1563.
Porina determinata Meyrick, Proc. Linn. Soc. N.S. Wales, iv (2), 1889, p. 1122.

♂ Antennae short, reddish-ochreous, pectinations short, 1½-2; palpi brown, smooth-haired, long; third segment three times as long as wide; head and thorax dull brown, abdomen pale reddish-ochreous, apex slightly darker. Forewings sub-hyaline, dull brown, with sparse silvery-white scales forming a median and a subterminal series of markings; a well-defined brown marginal white spot at r-m vein; costa with a subapical bright reddish-ochreous suffusion. Hindwings hyaline, pale greyish-brown, costal margin suffused with reddish-ochreous; base clothed with pale reddish-ochreous hairs. Expanse 66 mm.

♀ Antennae reddish-ochreous, short, obsoletely bi-pectinate; palpi long, terminal segment long, swollen at apex, smooth-haired; head and thorax dull fawn;

abdomen pale fawn, at apex slightly darker. Forewings hyaline, grey, traces of a white spot at r-m vein, and another slightly nearer to base. Hindwings grey, with base sparsely clothed with pale fawn-coloured down. Expanse 80 mm.

Loc. Western Australia: Swan River; Perth 5, 7, 11 (July, 1908, C. French, allotype female, I. 18886 in S. Aust. Mus.). 6 males, 1 female.

The type, a male in the British Museum Collection, has been figured (fig. 123). Some male examples (fig. 125) have a large series of dull greyish-white markings on the forewings, these are absent or obscured in the typical form.

Fig. 122–125. *Oxycanus determinatus* (Walker). 122, a male, Swan River; 123, type, a male, Swan River; 124, allotype female, Perth; 125, male, Perth.

Walker, in his description, makes special reference to the unusually prominent palpi, thus leaving little doubt as to the identity of his species. The wide divergence between the emergence dates of the three specimens bearing such data is worthy of special note, for in most of the species of *Oxycanus* hitherto examined, the time of emergence seems to be limited to a relatively brief period during each year. The anomaly will doubtless be elucidated when more material is available, and it may then be discovered that there are allied species or forms included under the present name.

OXYCANUS BYRSUS (Pfitzner).

Fig. 126.

Abantiades byrsa Pfitzner, in Pfitzner and Gaede, Seitz Macrolepidoptera, x, 1933, p. 834, pl. 75e.

♂ Antennae with pectinations short. Forewing with costal margin slightly concave at one-third, apex acute, with well-rounded termen and inner margin, dark brown, with brown and dull greyish-white markings. Hindwings ochreous, tinged with pink near base. Expanse 134 mm.

Fig. 126. *Oxycanus byrsus* (Pfitzner), male, New South Wales (after Seitz).

Loc. New South Wales.

O. maculosus and this are the only species that have not been examined during the progress of this revision. The venation of the figure given by Pfitzner seems to indicate that its position is in this genus rather than in *Abantiades*.

OXYCANUS MACULOSUS (Felder).

Fig. 127.

Pielus maculosus Felder, Reise Novara, ii, 1868, pl. 81, f. 1.

♂ Description not available.

Loc. New South Wales: Clarence River (type, a male, unique, in Tring Museum Collection).

This species appears to be close to *O. australis*, but a consideration of the limited climatic range of most Australian Hepialids and the absence of any other

records of *O. australis* in New South Wales, together with differences apparent in the photograph of the type, leads to the conclusion that *O. maculosus* is a distinct species. The Clarence River is an area of rain forest or "brush", and therefore differs considerably from Tasmania and Southern Australia. Through the courtesy of the authorities of Tring Museum, the type has been figured; it lacks the antennae. From the rather poorly-coloured illustration in "Reise Novara", it

Fig. 127. *Oxycanus maculosus* (Felder), type, a male, Clarence River (in Tring Museum Collection).

may be judged that the forewings are reddish-ochreous, the hindwings pale reddish-ochreous, with the apex and termen broadly darker and the base bright reddish-ochreous, as is also the abdomen. The antennae in the illustration are only moderately long, and with the pectinations about 2-3.

It may also be compared with *O. ballux,* from which it differs in the forewing markings, and in the colour of the hindwings.

OXYCANUS AEDESIMUS (Turner).

Fig. 128-129.

Porina aedesima Turner, Trans. Roy. Soc. S. Aust., liii, 1929, p. 307.

♂ Antennae whitish-ochreous, feebly bidentate, denticular elevations clothed with dense hair. Head dark brownish-black; palpi black, the terminal segment smooth-haired; thorax dark brown, abdomen somewhat lighter. Forewings rounded, ample, greyish-brown, with three paler transverse bands embracing series of black spots and lines, first from one-half costa to one-half hind margin, second from two-thirds costa to two-thirds hind-margin, and third from near apex to hind-margin. One or more of the black spots bear a fawn-coloured centre.

Hindwings dull ochreous-brown, the base yellow; ciliae greyish-brown. Expanse 55 mm.

Loc. Queensland: Eungella 10 (type in Turner Collection). 2 males.

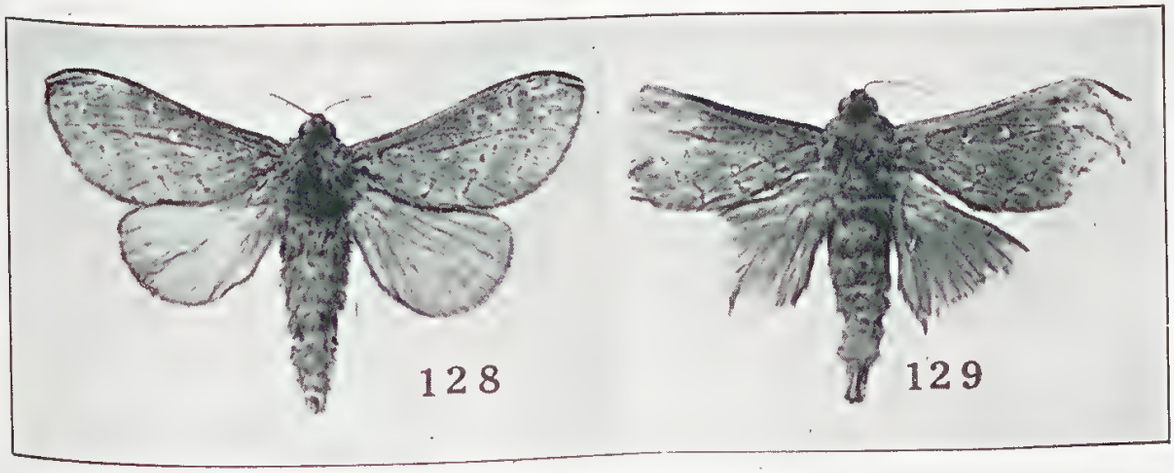

Fig. 128–129. *Oxycanus aedesimus* (Turner). 128, type, a male, Eungella; 129, male, Eungella.

This is a distinctive species, apparently not closely allied to any other. Through the kindness of Dr. A. J. Turner I have been able to examine the type, and also a second, much battered and larger male specimen taken at the same time. Unfortunately the genitalia could not be examined. The rounded, short, and ample wings and slender antennae distinguish this species from *O. silvanus*, which has similar markings on the forewings.

NOTE ON THE BODY TEMPERATURE OF A HEPIALID MOTH *(Trictena)*.

In June, 1935, a freshly-emerged male of *Trictena argentata* was found resting beside a path at Adelaide. It escaped from the hand, and before re-capture was chased by several sparrows, from which it was rescued with difficulty. It was noticeably warm to the touch when held in the hand, and when liberated in a half-dark room it flew rapidly about, finally landing beside a window. The warmth of its body was again casually noted. Having placed it in a cyanide jar, a doubt was raised as to the possible significance of the warmth, and the moth was at once removed. Tests were made with a special thermometer, such as is used in studying human skin surface temperatures. At 2.30 p.m., shortly after it had been retrieved from jar, the moth had a body temperature of 21° Centigrade (room temperature 16·3° Centigrade). After 13 minutes this had dropped to 19°, but as it recovered from the effects of the cyanide gas it began to vibrate its

wings slightly, and its temperature rose again quite regularly from 19·3° at 2.49 p.m. to 21·0° at 3·07 p.m., and to a rather stable condition at 24·0° at 3.48 p.m. (room temperature 16·5°). At 3.55 p.m. it flapped its wings violently for half a minute, and then continued to vibrate them; the temperature rose again to a maximum of 26·5° at 4.45 p.m. when the room temperature was 16·0°. The temperature of the moth at the conclusion of the observation was 25·0°, and the room temperature 17·2°. It is of interest to note, therefore, that the body temperature of a *Trictena* moth may be more than 10° Centigrade above that of its surroundings, and in active flight may reach still higher.

On the OCCURRENCE in AUSTRALIA of ACARINA of the FAMILY TENERIFFIIDAE (TROMBIDOIDEA)

By H. WOMERSLEY, F.R.E.S., A.L.S., Entomologist, South Australian Museum.

Fig. 1-2.

The family *Teneriffiidae* was erected in 1911 by Dr. Sig Thor (Zool. Anz. 38, 171-179) for two new genera, each with a single species. *Teneriffia quadripapillata* was described from Teneriffe and *Parateneriffia bipectinata* from Paraguay. A translation of Sig Thor's description of the family is as follows:

"Body elongate with running legs. Cuticle weak with striations; without crista or chitinized plates. Front forwardly produced, with three pairs of setae. Two widely separated pairs of eyes. Anus at end of body visible from above and below.

"The long genital opening of sickle-shaped valves with few hairs. No (either inner or outer) genital discs present. Legs simple, with setae; the two claws, at least on the four front legs, with double combs; hind legs sometimes with a third 'intermediate' claw. Mouth-parts: rostrum short and broad; the distal end of the labium on the under side with four short stumpy papillae and two pairs of setae; mandible two-segmented, claw-like, with two small setae on the dorsal side.

"Palpi five-segmented, thick, strong, and curved, with long terminal claw and few setae. On the inner side of segment IV and behind the terminal claw are two chitinized papillae; segment V (thumb) quite rudimentary but with many (6-7) long setae."

In 1924 (Proc. Zool. Soc. London, p. 1078) Hirst erected the genus *Neoteneriffiola* for the species *N. luxoriensis* Hirst from Egypt, and in the following year (loc. cit. p. 1278) he erected the genus *Heteroteneriffia* for a marine species, *H. marina* Hirst from the Federated Malay States.

Amongst the collection of Acarina made by Hirst while in Australia in 1927-28, and later presented to the South Australian Museum by Prof. T. H. Johnston to whom they had been left, was a single preparation of five specimens which had been provisionally labelled by Hirst as belonging to the genus *Neoteneriffiola*.

I have now been able to study these specimens as well as two others belonging to this family which have recently come to hand. As a result of this work it is now clear that Hirst's provisional generic determination is incorrect and that his specimens will require a new genus. For this I propose the name *Austroteneriffia*,

and for the species the name of *hirsti* after the late Mr. Stanley Hirst, one of the few English Acarologists.

The other two specimens are even more interesting, and while requiring still another genus, are so strikingly different from all other known species of *Teneriffiidae* as to justify the splitting up of the family into two very distinct subfamilies, the *Teneriffiinae* and the *Rhaginae*. The first subfamily is defined by the elliptical form, no cephalothoracic separation from the abdomen, the paired eyes on each side being adjacent, and the claws of one or both of the front pairs of legs being strongly pectinate. To this family belong all previous known genera as well as the new genus *Austroteneriffia*. The *Rhaginae* is represented by the new genus and species *Rhagina protea*, and can be defined as not having an elliptical form, with narrow elongate cephalothorax well separated from the much wider abdomen, with the eyes on each side widely separated, claws all small, indistinct, and without pectinations.

FAMILY TENERIFFIIDAE Sig Thor 1911.

Subfamily Teneriffiinae subfamily nov.

Definition: Body form elliptical. Cephalothorax not separated from abdomen. Eyes adjacent. Claws large and distinctly pectinated, at least on legs I or I and II. Genital discs absent or present.

Genus AUSTROTENERIFFIA gen. nov.

Description: Body form elliptical without any marked separation of cephalothorax from abdomen. Eyes, a pair on each side, adjacent. Claws of legs I and II large and strongly bipectinate, III and IV small and only indistinctly pectinated, the teeth being short. Anterior edge of coxae without a distinct row of setae, only 2-3 present. Genital discs present, three pairs.

Genotype: Austroteneriffia hirsti sp. nov.

Remarks: This new genus is most closely related to *Heteroteneriffia* Hirst in that it possesses genital discs. Sig Thor in his description of the genera *Teneriffia* distinctly states that no genital discs are present, but in Hirst's descriptions of *Neoteneriffiola* and *Heteroteneriffia* no mention of the presence or absence of these is made. However, in the figure of the ventral surface of *Heteroteneriffia marina* Hirst, the presence of at least two pairs are distinctly indicated. From *Heteroteneriffia* the new genus differs in having the claws of both legs I and II strongly pectinated (on legs I only in *Heteroteneriffia*) and in not having a definite row of setae on the anterior margins of the coxae.

AUSTROTENERIFFIA HIRSTI sp. nov.

Description: Length idiosoma 866μ, gnathosoma 300μ, opisthosoma 415μ. Palpi 300μ, segment II very much enlarged, 133μ wide. Mandibles 250μ long. Cephalothorax not differentiated from abdomen, although there is a fold running across between the eyes; with three pairs of setae and a pair of fine sensory hairs, 66μ long, arising from rosettes. Eyes, a pair on each side, adjacent. Palp II

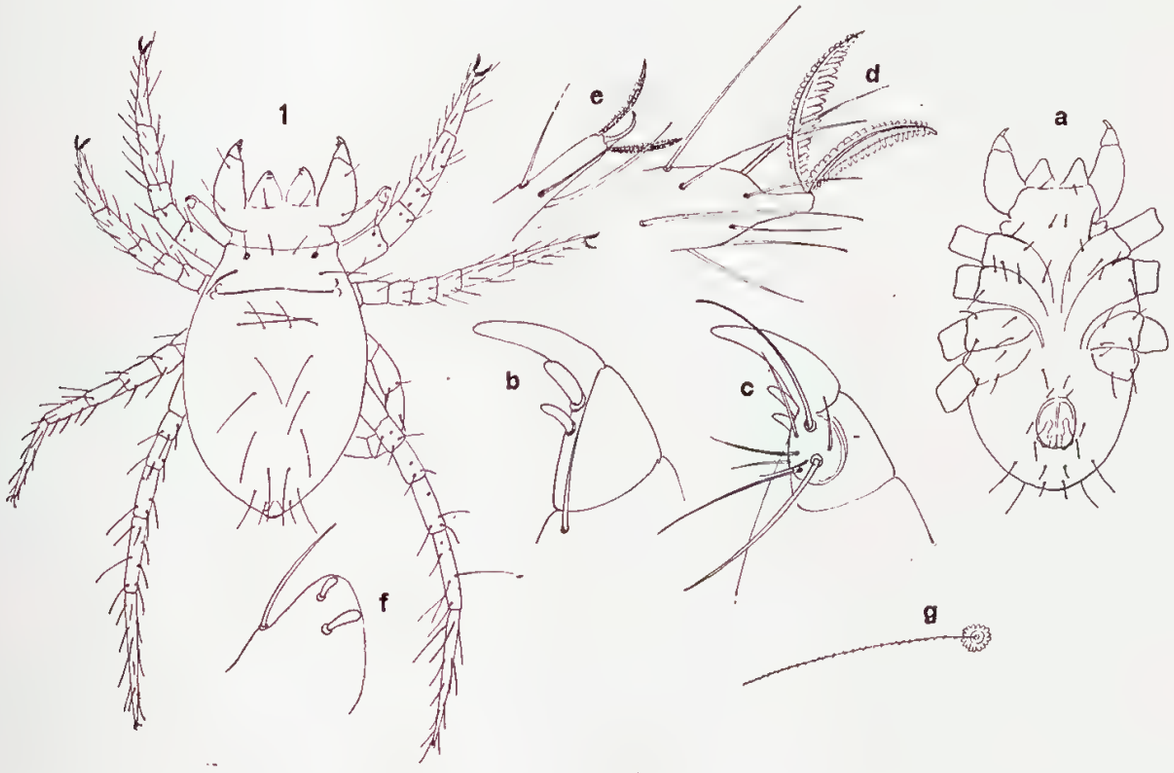

Fig. 1. *Austroteneriffia hirsti* sp. nov.: 1, dorsal view of entire animal, mandibles somewhat displaced; a, ventral view of same; b, apex of palp from above; c, same from below; d, tip of tarsus and claws of leg; e, same of leg III, f, half of apex of labium from below; g, cephalothoracic sensory hair.

with two dorsal setae, III without a process, tibia with large terminal and two accessory claws, tarsus rudimentary as in the family and with the usual setae. Legs, I 1000μ long, tarsus with a pair of long (83μ) bipectinate claws; II 1000μ, claws 66μ long, bipectinate; III 1083μ long, claws 40μ long, only indistinctly pectinated and short-toothed, a third median simple and shorter claw present; IV 1298μ long, claws 33μ long, otherwise as in III. Abdomen with rather long, stout, slightly ciliated setae, the outer setae of the row of four immediately behind the eyes are 280μ long, the others somewhat shorter. Dorsal surface finely striated, the striations somewhat stronger on the shoulders and wanting in the middle of the cephalothorax, there perhaps indicating a dorsal plate. Coxae in two groups, not widely separated by a narrow strip of striated cuticle, with comparatively

few setae, these not forming a distinct row along the anterior coxal margins. Coxae I and II narrowly separated along the medial line, III and IV more widely so. Genital opening large, about two-thirds as long as the distance separating it from the posterior coxae; with three pairs of discs. Anus large, terminal and visible both dorsally and ventrally. Colour probably reddish-purple.

Locality: Type and four paratypes (on one slide) taken by Hirst at Menindie, South Australia, in July, 1928.

Remarks: This species is very well differentiated from all others by the generic characters. The fine sensory hairs arising from rosettes have only been observed in *Heterotenerіffia marina* Hirst. Apparently they do not occur in other than these two species.

Subfamily Rhaginae subfamily nov.

Definition: Body form characteristic with narrow elongate, parallel-sided cephalothorax well separated from the broader abdomen. Eyes, two on each side, widely separated. Claws small and indistinct, simple. Genital discs absent. Anus entirely dorsal and subterminal.

Genus RHAGINA gen. nov.

Description: As for the subfamily.
Genotype: Rhagina protea sp. nov.

RHAGINA PROTEA sp. nov.

Description: Length idiosoma 533μ, gnathosoma 187μ, opisthosoma, 143μ. Palpi long, 187μ, segment II much broadened, with one dorsal seta, III short, without process, tibia with apical claw and two small stumpy accessory claws, tarsus rudimentary as in the family and with the usual setae. Mandibles as figured. Legs: I 525μ long, antennaeform, with long slender praetarsus and small indistinct claws, apically with long setae; II 257μ long, stouter; III 345μ; IV 440μ; all claws small and without combs; III and IV without the third median claw. Cephalothorax elongated, straight-sided, 170μ long by 143μ wide, with three pairs of strong setae; eyes two on each side, widely separated, the front pair being situated at the anterior corners of the cephalothorax, the posterior pair midway down the lateral margins. Abdomen anteriorly broad, 257μ, with well developed shoulders, each with a seta 110μ long; from the shoulders the abdomen tapers towards the apex. The dorsal setae are short (34μ) stout, simple, and disposed as figured. The anus is entirely dorsal, on each side with a pair of long setae (100μ). Ventral surface: the coxae in two widely-separated groups, those of

legs I and II large, practically touching in the medial line and with few short setae; III and IV widely separated in middle line and basally indistinct. Genital opening long and narrow as figured.

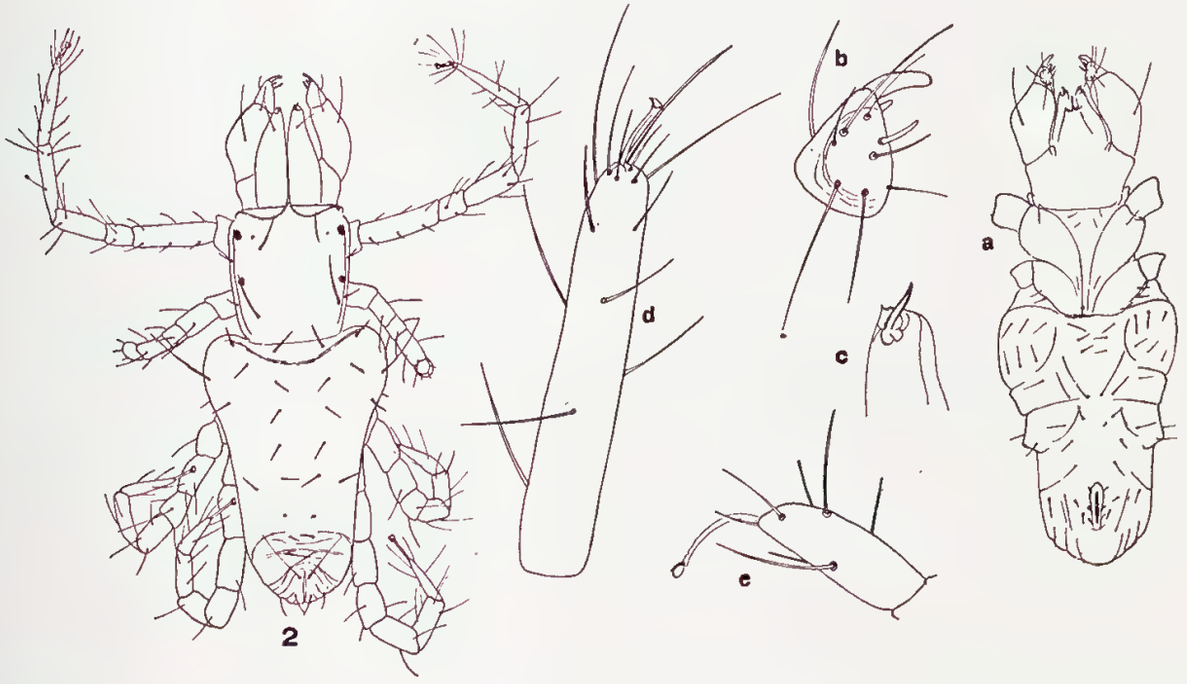

Fig. 2. *Rhagina protea* sp. nov.: 2, dorsal view of entire animal; a, ventral view of same without legs; b, apex of palp from below; c, tip of mandible; d, tarsus of leg I; e, tarsus of leg III.

Locality: Type from moss from Glen Osmond, South Australia, Apr./35 (R.V.S.); a second specimen from moss from Myponga, South Australia, Apr./35 (R.V.S.).

Remarks: Superficially this species suggests the form of the Rhagidiidae.

KEY TO THE GENERA AND SPECIES OF TENERIFFIIDAE.

1. Body form elongate-oval. Cephalothorax not separated from abdomen. Eyes adjacent. Claws large, pectinate on legs I, or I and II. Genital discs present or absent .. .. 2.
   Subfamily *Teneriffiinae* nov.

   Body form not so. Cephalothorax much narrower than the broader abdomen and separated therefrom. Eyes widely separated. Claws small and simple, not pectinated. Legs I antennaeform .. Subfamily *Rhaginae* nov.
   Genus *Rhagina* nov:
   protea sp. nov. Australia.

2. Genital discs absent .. .. 4.
   Genital discs present. Palp III without process .. .. .. 3.

3. Only claws of legs I large and strongly pectinate. Anterior edge of coxae with a distinct row of 5-6 setae. Marine Genus *Heterotenerifia* Hirst, 1925.
   marina Hirst 1925, Fed. Malay St.

Claws of legs I and II large and strongly pectinate. Anterior edge of coxae without distinct row of setae, with only 2-3 irregularly placed ones.

Genus *Austroteneriffia* nov.

hirsti sp. nov. Australia.

4. Palp III with appendage. .. .. 5.

Palp III without appendage. Claws of legs I and II large, strongly pectinate. Coxae with row of setae on anterior margins.

Genus *Teneriffia* Sig Thor 1911.

quadripapillata Sig Thor 1911 Teneriffe.

5. Coxae I and II touching in medial line, anterior edge of coxae III with a row of 6 strong setae. Genital opening large. Claws on leg I only pectinated.

Genus *Parateneriffia* Sig Thor 1911.

bipectinata Sig Thor 1911, Paraguay.

Coxae I and II separated in medial line, anterior edge of coxae III with only 3 setae. Genital opening smaller. Claws of leg I only pectinated.

Genus *Neoteneriffiola* Hirst 1924.

luxoriensis Hirst 1924, Egypt.

RECENT AUSTRALIAN VIVIPARIDAE AND A FOSSIL SPECIES

By BERNARD C. COTTON, Conchologist, S.A. Museum.

Fig. 1-20.

Like most species of Australian fresh water mollusca, those belonging to the family *Viviparidae* have received little attention from conchologists.

Smith (1) commenting on the genus *Vivipara* remarks that "Two peculiarities are constant in all Australian species of this genus. Every example that has come under my examination exhibits spiral sculpture; and in none of them are colour bands found below the periphery". One species *V. alisoni* Brazier (2) (type locality Diamantina River, Queensland) was described as smooth, but a close examination of typical specimens from Ayr, Lower Burdekin River, Queensland, shows even under a magnification of 40 diameters, the peculiar microscopic granose spiral lirae common to all Australian species. The genus *Notopala* is here erected for the Australian species exhibiting this sculpture.

Notopala gen nov.

Shell globuse-conic, subumbilicate, whorls five, ventricose, with a tendency to angulation subsuturally and at the base; epidermis olive, polished; sculpture of microscopic granose lirae on the whole of the outer surface; aperture subovate, operculum corneous, nucleus subcentral, nearer the columella margin; unicoloured or with spiral colour bands on and above the periphery. Animal oviviparous, living in mud at low water mark and below in fresh water rivers and lakes.

Genotype. *Paludina hanleyi* Frauenfeld, from the Lower Murray River. A chronological list of species, represented in the South Australian Museum Collection, which may be referred to this genus, is given here.

Notopala sublineata Conrad, 1850 (type loc., Darling River, N.S.W.).
Notopala essingtonensis Frauenfeld, 1862 (type loc., Port Essington, N.A.).
Notopala hanleyi Frauenfeld, 1862 (type loc. Lower Murray River, S.A.).
Notopala australis Reeve, 1863 (type loc., Victoria River, N.A.).

(1) Smith, E. A., *Proc. Linn. Soc.*, 1881, xvi, p. 262.
(2) Brazier, J., *Proc. Linn. Soc., N.S.W.*, 1879, iii, p. 221.

Notopala ampullaroides Reeve, 1863 (type loc., Victoria River, N.A.; also Fitzroy River, N.W.A., Smith); syn. of *N. essingtonensis* Frauenfeld.

Notopala kingi Ads. & Ang., 1863 (type loc., King's Ponds, C.A.).

Notopala waterhousei Ads. & Ang., 1863 (type loc., Newcastle Waters, N.A.).

Notopala intermedia Reeve, 1863 (type loc., Lower Murray River); syn. of *N. hanleyi* Frauenfeld.

Notopala polita Martens, 1863 (type loc., Balonne River, Q.).

Notopala affinis Martens, 1865 (type loc., Fitzroy River, N.W.A.).

Notopala purpurea Martens, 1865 (type loc., Murray River); syn of *N. hanleyi* Frauenfeld.

Notopala suprafasciata Tryon, 1866 (type loc., Tropical Australia); syn of *N. essingtonensis* Frauenfeld.

Notopala alisoni Brazier, 1878 (type loc., Diamantina River, Q.).

Notopala tricincta Smith, 1882 (type loc., N.A.); closely allied to *N. essingtonensis* Frauenfeld.

Notopala dimidiata Smith, 1882 (type loc., Victoria River, N.A.).

NOTOPALA WANJAKALDA sp. nov.

Shell globose conic, body whorl bi-angulate, bearing a valid carina at the lower angle; umbilicus small; whorls five, the protoconch and first and second whorls eroded; surface with characteristic australoid microscopic spiral granose lirae; aperture subovate; outer lip continuous with columella lip and medially produced into a prominence corresponding with the carina.

Holotype. Height 6 mm., diam. 17 mm. Fossil (Upper Pleistocene?). In the banks of the River Murray near Sunnyside, Section 174, Hundred of Burdett, horizon 9. D.11451 S.A. Museum.

The species differs from the recent *N. hanleyi* Frauenfeld in the valid unicarination exhibited in some forms, the tendency to sharper angulation of the whorls and the coarser spiral granose lirae which are well preserved in most specimens.

Mr. C. P. Mountford recently brought to the South Australian Museum some shells taken from the banks of a dead creek which entered the Murray near Sunnyside four miles upstream from Murray Bridge, South Australia, Section 174, Hundred of Burdett. The specimens were collected by Mr. Mountford during a trip to this area in company with Drs. C. Fenner, T. D. Campbell, and C. Hackett. Amongst the specimens was a remarkable unicarinate fossil *Notopala* unlike any recent Australian species. Three visits were made to the site by the author to make further investigations. The Murray River cliffs rise to a height

of 300 feet above river level at this point. A section of the cliffs, disclosed by the creek's bank may be tabulated thus:

Horizon.	Composition.	Thickness.	Height above river level and approximately above sea level.	Remarks.
1	Surface yellow sand	60 cm.	93 metres	
2	Packed mussel shells *Hyridella protovittatus* in blackened sand	30 cm.		Probably a native campsite. Some other layers exposed near this site have not the blackened appearance, and represent old river levels.
3	Yellow sand	15 cm.		
4	Dark sand	53 cm.		
5	First layer of *Notopala*	10 cm.		*Notopala* sp. visible only at certain places.
6	Yellow sand	36 cm.		
7	Second layer of *Notopala*, cf. *wanjakalda*	10 cm.	91 metres	Plainly visible for horizontal distance of about 3 metres.
8	Yellow sand	76 cm.		
9	Third layer of *Notopala wanjakalda*	15 cm.	90 metres	Partly obscured by recent falls of surface sand.

Horizon 5 contains numerous closely-packed specimens of a fossil *Notopala* nearly allied to the recent *N. hanleyi* Frauenfeld.

Horizon 7 contains just as closely-packed specimens of *Notopala* c.f. *wanjakalda* ranging from a non-carinate to a prominently carinate form. This carina is situated at a lower angle of the body whorl. On the penultimate whorl it is covered by the upper margin of the body whorl, but juvenile specimens show the carina to have been present at a very early stage. In Horizon 9 a similar series of *Notopala wanjakalda* is found where 40 per cent. show signs of unicarination.

The holotype of *Notopala wanjakalda* was taken from this lowest horizon. The species found in horizon 7 is probably identical.

The narrow compact horizons (5, 7, 9) at which the *Notopala* were obtained probably represent old river levels; members of this genus are found living most abundantly in the shallow marginal waters near low river level. It will be noticed that the lowest horizon is 90 metres above present river level, and the occurrence seems to show the existence of a base level of low water much above that of the present river level.

This is of interest because on other grounds Tindale (3) has shown the probability of a series of Pleistocene marine terraces occurring in the region of the Murray River, the oldest near Fromm Landing and successively younger ones between there and the present coast line.

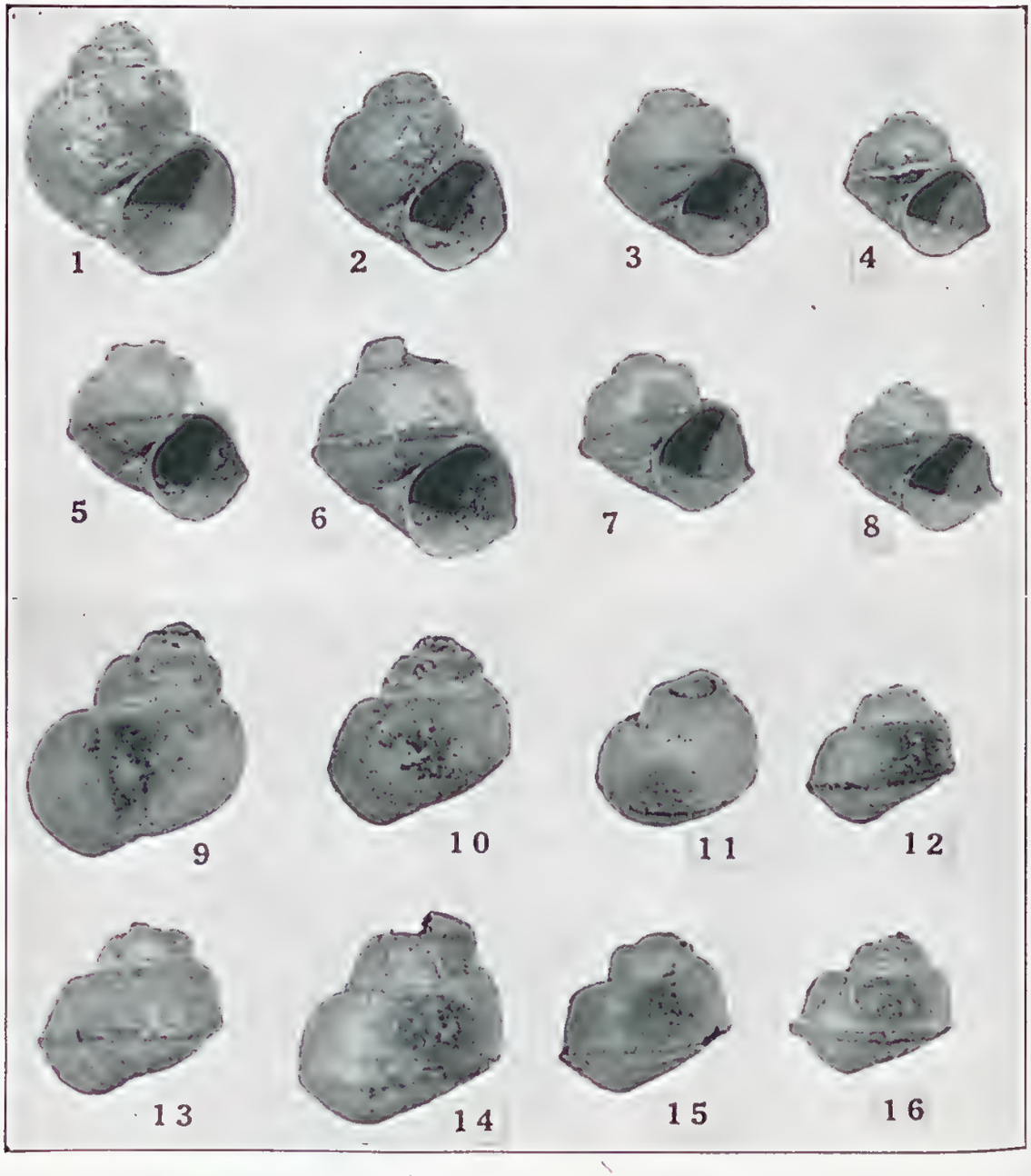

Fig. 1–16. *Notopala wanjakalda* sp. nov. 1–8, Ventral views; 9–16, dorsal views (8 and 16 show the holotype). All nat. size.

Does this *Notopala wanjakalda* horizon correspond with Tindale's Reedy Creek Terrace? The sculpture of the shell may indicate a warmer climate than now exists at this place, as the raised beach marine fossils do elsewhere in South

(3) Tindale, N. B., *Trans. Roy. Soc., S. Aust.*, lvii, 1933, pp. 137, 139.

Australia. Associated with the *Notopala wanjakalda* are odd specimens of a fresh water mussel rather different in shape from the recent *Hyridella australis* Lamarck, being more like the *Hyridella angasi* Reeve in general contour.

The native camp site layer has specimens of a fresh-water mussel probably allied to the recently extinct *Hyridella protovittata* Hale & Tindale (4) which was the dominant food shell of the natives who lived on the Tartangan camp site at Tartanga.

CENTRAPALA gen. nov.

Shell subglobose, thick, imperforate; spire depressed, obtuse, eroded at the apex and early whorls; suture much impressed; whorls four, rounded, somewhat flattened posteriorly and sculptured with prominent lirae, six or seven on the penultimate whorl, with sometimes a fine interstitial; base obsoletely spirally

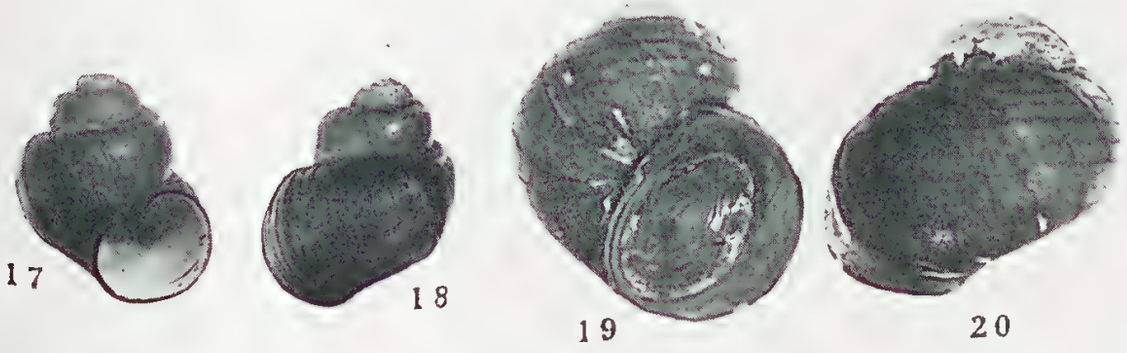

Fig. 17–18. *Notopala hanleyi* Frauenfeld. Nat size. Fig. 19–20. *Centrapala lirata* Tate. × 1½.

sculptured; operculum horny, concentric, nucleus nearer the columella margin; animal oviviparous giving birth to six or eight embryos of 3 mm. diameter.

Genotype. *Paludina lirata* Tate, Cooper Creek at Innamincka, C.A. (Holotype D.11450 S.A. Mus.).

Embryonic shells diaphanous, pale green, carinated on the periphery of the last whorl and the base strongly striated.

In 1885 Tate (5) introduced *Paludina lirata* remarking that: "The species is quite unique amongst Australian congeners". It is certainly generically distinct from any other species, being somewhat like a lirate *Larina*, though probably more nearly related to *Notopala*. Tate's figure of the type is not accurate, so the specimen is here refigured.

(4) Hale, H. M. and Tindale, N. B., *Rec. S. Austr. Mus.*, iv (ii), 1930, p. 156.
(5) Tate, R., *Trans. Roy. Soc., S. Aust.*, ix, 1885, p. 63, pl. iv, fig. 6a–b.

Readily distinguished from all other genera of this family by the spiral sculpture, depressed obtuse spire, impressed suture, large, oblique semi-circular aperture and rounded, not subangulate whorls.

The genus *Larina* Adams (genotype *L. strangei* Adams) is recorded from fresh water at Moreton Bay and Mackenzie River. Thiele places *Larina* in the family *Melaniidae*. Gatliff and Gabriel ([6]) described *Larina ? turbinata* from five fathoms, Western Port, Victoria, and later made it the genotype of *Larinopsis* Gatliff and Gabriel ([7]). Thiele places this genus as a section of *Megalomphalus* Brusina 1871, which is located in the family *Fossaridae*.

(6) Gatliff, J. H. and Gabriel, C. J., *Proc. Roy. Soc., Vict.*, xxii (n.s.), 1909, pl. i, p. 35.

(7) Gatliff, J. H. and Gabriel, C. J., *Proc. Roy. Soc., Vict.*, xxix (n.s.), 1916, pt. 1, p. 104.

FISHES FROM PRINCESS CHARLOTTE BAY, NORTH QUEENSLAND

By GILBERT WHITLEY, Ichthyologist, The Australian Museum, Sydney.

(By Permission of the Trustees of the Australian Museum.)

Fig. 1-11.

The fishes listed in this paper were collected by Messrs. Herbert M. Hale and Norman B. Tindale, of the South Australian Museum, during an expedition to northern Queensland in 1927. Details of their field work have been given in their account of the aborigines, (1) to which reference may be made for maps and geographical data. The fishes belong to coastal Queensland forms and are thus Banksian (2) in facies, being quite distinct from the Solanderian or purely coral reef forms. At some places, such as Low Isles, the former headquarters of the British Great Barrier Reef Expedition, both the Banksian and Solanderian forms have been found, though each is restricted to its special habitat. From Bathurst Head, the collectors obtained a number of small fishes, labelled "'Telkara". Thirty-two of these are *Ambassis*, two are *Terapon puta*, and one is a damaged *Mugil*. A small Toadfish in the same batch is *Chelonodon patoca*, and a larger Toadfish, called "Adadi", is *Ovoides manillensis virgatus*.

The majority of the collection was made inshore at Flinders Island, where by far the commonest fish was *Bathygobius fuscus darnleyensis*.

A feature of the collection is the series of *Centrogenys* and *Sebastapistes*, showing the former, a Percoid fish, mimicking the latter, a Scorpaenoid, in form and coloration.

The specimens are preserved in the South Australian Museum, Adelaide. The opportunity is taken to present the results of some detailed researches into the status of some species of Chandidae, in connection with the discovery of a new species of *Ambassis* by Messrs. Hale and Tindale.

Family MURAENIDAE.

Gymnothorax Bloch, 1795.

Gymnothorax melanospilus (Bleeker).

Muraena melanospila Bleeker, Nat. Tydschr. Ned. Ind., ix, 1855, p. 279, Sibogha, Sumatra.

(1) Hale and Tindale, Rec. S. Austr. Mus., v, 1933, p. 63.
(2) Whitley, Austr. Nat., viii, Dec. 1932, p. 166.

One specimen 154 mm. long from Flinders Island has light margins to the dorsal and anal fins and measures 70 mm. from snout to vent.

FAMILY MUGILIDAE.

MUGIL Linné, 1758.

MUGIL, sp.

A small mullet, 52 mm. in standard length, from Bathurst Head, and another of 42 mm. from Flinders Island, are too small or too damaged for precise identification. D. iv/9; A. ii/9 or 10. Sc. 36. L. tr. 13. No adipose eyelids. Upper teeth very deep but not crenulate. Extremity of maxillary visible. No teeth. Angle of preorbital strongly denticulated. Soft dorsal and anal fins with scaly sheaths.

These specimens approach *M. ramsayi* Macleay and *M. convexus* De Vis, but do not agree exactly with either.

ELLOCHELON Whitley, 1930.

ELLOCHELON VAIGIENSIS (Quoy and Gaimard).

Mugil vaigiensis Quoy and Gaimard, Voy. Uranie Physic., Zool., 1825, p. 337, pl. lix, fig. 2, Waigiou.

Two very small specimens, 21 mm. in standard length, from Flinders Island.

FAMILY EPINEPHELIDAE.

CENTROGENYS Richardson, 1842.

CENTROGENYS VAIGIENSIS (Quoy and Gaimard).

Fig. 1.

Scorpaena vaigiensis Quoy and Gaimard, Voy. Uran. Physic., Zool., Dec. 18, 1824, p. 324, pl. lviii, fig. 1, Waigiou.

Centropristes scorpenoides Cuvier and Valenciennes, Hist. Nat. Poiss. iii, April, 1829, p. 48. New name for *Scorpaena vaigiensis* Quoy and Gaimard, Waigiou.

Myriodon waigiensis Brisout de Barneville, Rev. Zool. Soc. Cuv., x, April, 1847, p. 133. Based on *Scorpaena vaigiensis* Quoy and Gaimard, Waigiou.

Sebastes stoliczkae Day, Fish. India i, Aug., 1875; p. 148, pl. xxxvi, fig. 1, Nicobars.

Gennadius stoliczae Jordan and Seale, Bull. U.S. Bur. Fish. xxvi, 1906 (1907), p. 37 *Ex* Day.

Rhabdosebastes stoliczae Fowler and Bean, Proc. U.S. Nat. Mus. lxii, 2, July 28, 1922, p. 60 (Philippines).

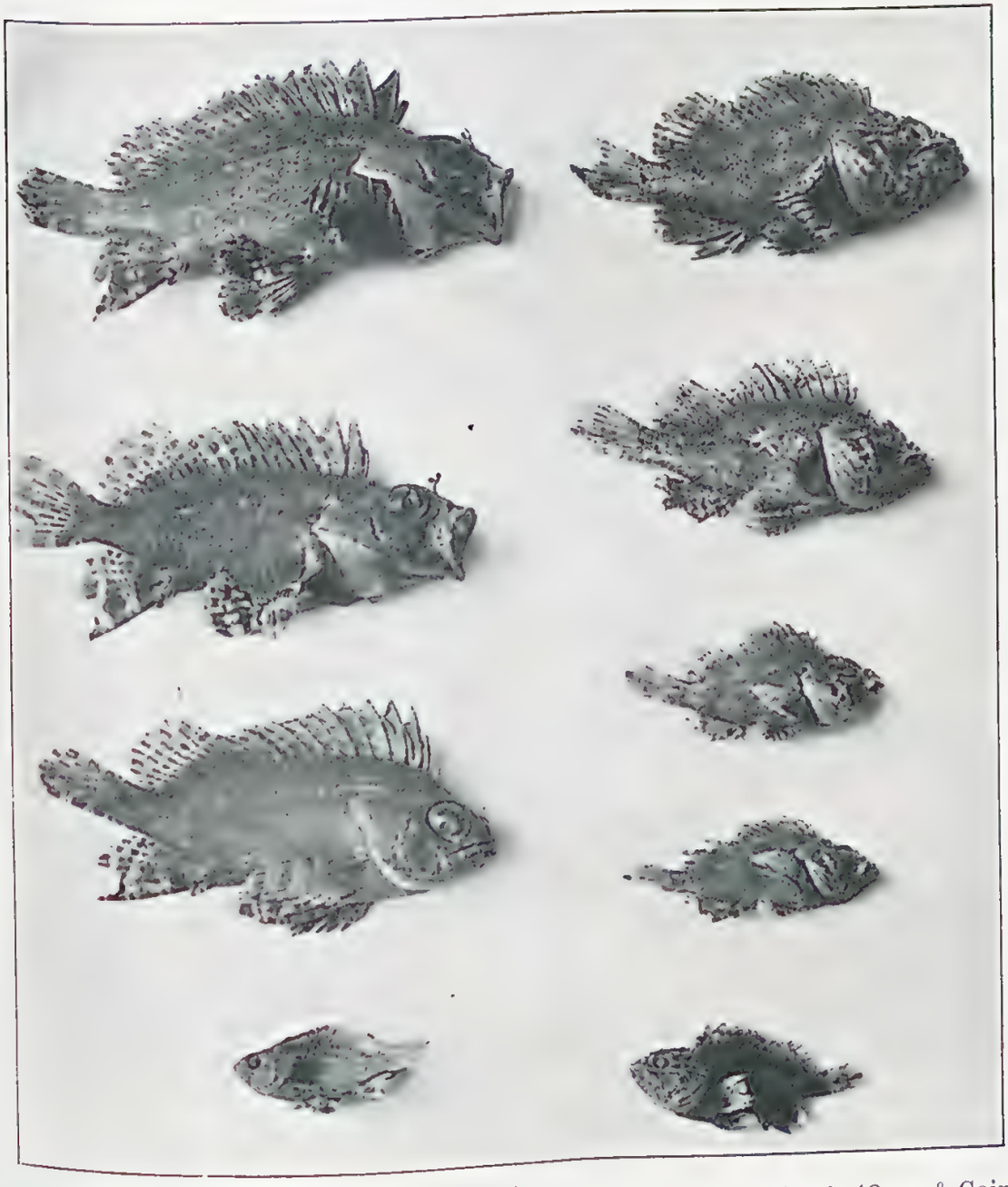

Fig. 1. Four specimens (left) of the Percoid fish *Centrogenys vaigiensis* (Quoy & Gaimard) showing the superficial resemblance to the Scorpaenoid fish *Sebastapistes bynoensis laotale* Jordan and Seale. (Photo, G. C. Clutton).

Four specimens, 26-66 mm. in standard length from Flinders Island.

This species may perhaps be termed the *pons asinorum* of ichthyology as, derived from a Percoid stock, it has evolved a striking superficial resemblance to the Scorpaenoid fishes and has several times been redescribed as a new genus of Scorpaenidae, notwithstanding its lack of the characteristic posterior projection

from the suborbital bones extending across the cheek to the preoperculum. The Scorpaenoid or Scorpion fishes are sluggish creatures with venomous spines on the head or in the dorsal fin, so that the harmless *Centrogenys* may derive some fortuitous benefit from resembling them, and the accompanying photographs of specimens of the Scorpaenoid *Sebastapistes*, collected by Messrs. Hale and Tindale at the same place as the *Centrogenys*, emphasize their similarities and differences in a manner which does not seem to have been previously presented.

A certain amount of mimicry, or at least a remarkable convergence in facies, appears to be noticeable in several fishes of the coral seas. My Eleotrid genus *Gignimentum* is strangely like a Trichonotid. The goby *Obtortiophagus* rather recalls the more ornate Eleotridae like *Amblygobius*. Several dredged forms resemble small stones or rocks and thereby appear similar to one another: thus, the quaint Angler Fish, *Tetrabrachium*, which I have recently recorded from Hayman Island, at first appeared to me like a small *Erosa*, a relative of the Stonefish.

Here is an interesting subject for future elaboration, yet one in which conclusions must be arrived at with caution.

Probably subspecies or races of *C. vaigiensis* will be later distinguished; Fowler and Bean, for instance, noticed that the Philippine form was not typical "*stoliczkae*".

FAMILY TERAPONTIDAE.

TERAPON Cuvier, 1816.

TERAPON PUTA Cuv. and Val.

Therapon puta Cuvier and Valenciennes, Hist. Nat. Poiss. iii, April, 1829, p. 131. Pondicherry, etc., India.

Terapon puta Fowler, Bull. U.S. Nat. Mus., 100, xi, 1931, p. 328 (references and synonymy).

Two small specimens, 22-25 mm. in standard length, from Bathurst Head, amongst "Telkara" (*Ambassis*).

FAMILY APOGONIDAE.

FOA Jordan and Evermann, 1905.

FOA FO Jordan and Seale.

Foa fo Jordan and Seale, Bull. U.S. Bur. Fish. xxv, 1905 (Dec. 15, 1906), p. 248, fig. 42, Apia, Samoa.

Six specimens, 17-31 mm. in standard length, from Flinders Island. Three (IA. 6047) retained for Australian Museum.

New record for Australia.

FAMILY CHANDIDAE.

AMBASSIS Cuvier and Valenciennes, 1828.

AMBASSIS TELKARA sp. nov.

Fig. 2.

D. vii/i, 9, A. iii, 9; L. lat. 27-28; L. tr. 3/1/7-8.

Eye (5 mm.) 3 in head (15). Depth of body (17) 2·6 in standard length (45). Second dorsal spine (11 mm.) 4·1 in same.

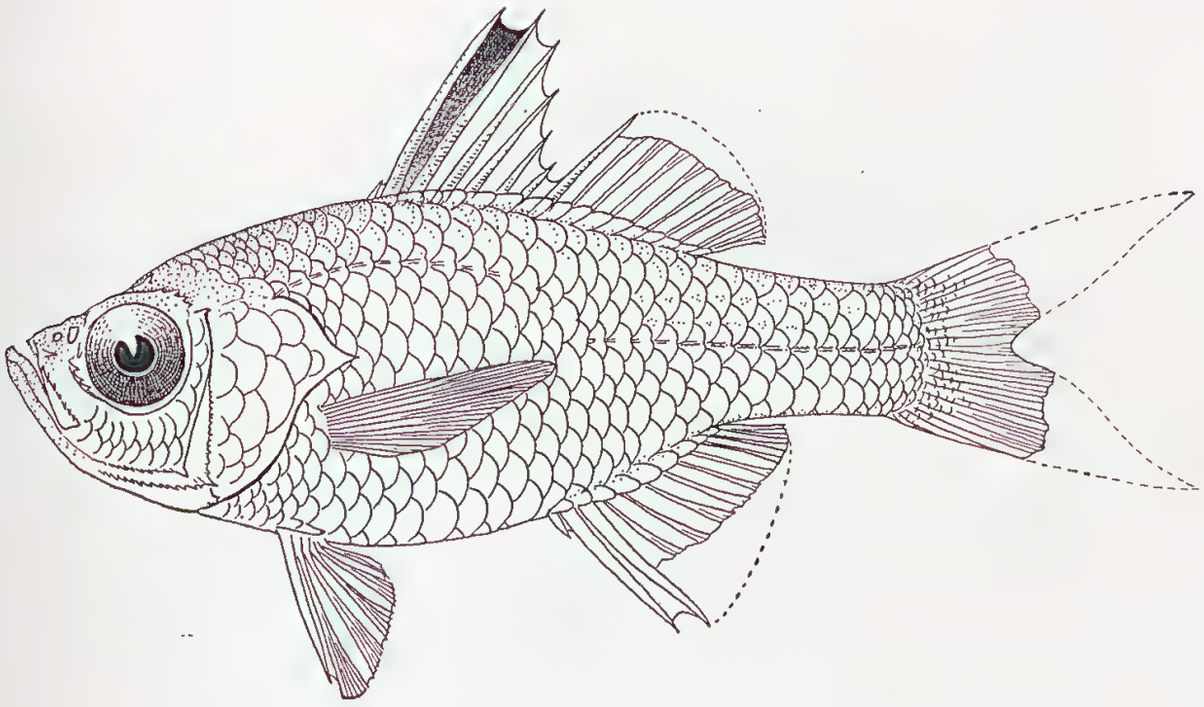

Fig. 2. *Ambassis telkara* sp. nov., holotype, × 2 (G. P. Whitley, del.).

Head longer than high. Spiny serrations on supraorbital, preorbital lower margins of preoperculum, and on each side of nape. Two rows of scales on cheek. Lower jaw longer than upper. Bands of regular villiform teeth on jaws and vomer. Tongue toothless. Maxillary reaching anterior fourth of eye, slightly dilated and with an obliquely truncate and slightly excavate posterior margin. Mandibular ramus sloping upward. Twenty or more gillrakers on lower half of first gillarch. Body fairly deep, compressed, scaly. Lateral line practically continuous, the tubes merely becoming weak where the curved portion approaches the straight. About fourteen predorsal scales. Procumbent dorsal spine concealed. Membrane between second and third dorsal spines blackish. Second anal spine strong but not as long as the third. Pectorals nearly as long as head with-

out snout. General colour in alcohol, straw yellowish, with dusky marks along top of back and punctulations on edges of superior scales. Caudal plain.

This species runs down to *Ambassis nalua* in Weber and Beaufort's key (Fish Indo-Austr. Archip. v, 1929, p. 389) but Hamilton-Buchanan's original figure of *Chanda nalua* shows a different fish with much deeper cheek, 11 dorsal rays, 10 anal rays, and depth of body half the standard length. The Australian species of this genus badly need revision, but the present one does not agree with any published description, and is accordingly described as new from the largest of a series of thirty-two somewhat damaged specimens, 26-45 mm. in standard length. At the end of this paper, I append some remarks on various genera and species of Chandidae which I have compared with this new form.

Six (IA. 6046) retained for Australian Museum.

Loc. Bathurst Head, North Queensland.

Native Name, *Telkara.*

FAMILY SPARISOMIDAE.

SCARICHTHYS Bleeker, 1859.

SCARICHTHYS AURITUS (Cuv. & Val.).

Scarus auritus Cuvier and Valenciennes, Hist. Nat. Poiss. xiv, "1839"=Jan. 1840, p. 218, *Ex* Kuhl and Van Hasselt MS. Java.

A young specimen, 33 mm. in standard length, from Flinders Island, is apparently referable to this species.

FAMILY LABRIDAE.

CHOERODON Bleeker, 1845.

CHOERODON SCHOENLEINII (Cuv. and Val.).

Cossyphus schoenleinii Cuvier and Valenciennes, Hist. Nat. Poiss. xiii, 1839, p. 143, *Ex* Agassiz MS. Celebes.

Choerops schoenleini Bleeker, Atlas Ichth. i, 1862, p. 163, pl. xlvi, fig. 3.

Chaerops notatus Alleyne & Macleay, Proc. Linn. Soc. N.S. Wales i, March, 1877, p. 344, pl. xvi, fig. 1. Cape Grenville, Queensland.

One specimen, nearly 110 mm. in standard length, from Flinders Island agrees well with Bleeker's figure and has cheeks scaly and pitted; preoperculum denticulate; lower opercular margin excavate; and five predorsal scales. The type of Alleyne and Macleay's species I have examined in the Macleay Museum, University of Sydney, and find it conspecific with *schoenleinii.*

FAMILY BLENNIIDAE.

Subfamily Petroscirtinae.

PAULOSCIRTES gen. nov.

Orthotype, *Petroscirtes obliquus* Garman, Queensland specimens.

No crest or tentacles on the head, which is about a quarter to one-fifth of the standard length. Snout blunt. A curved row of about thirty compressed incisors in each jaw. Canines of upper jaw well curved and lying outside the larger canines of the lower jaw. Gill-opening reduced to a small aperture lying above the level of the pectoral fins.

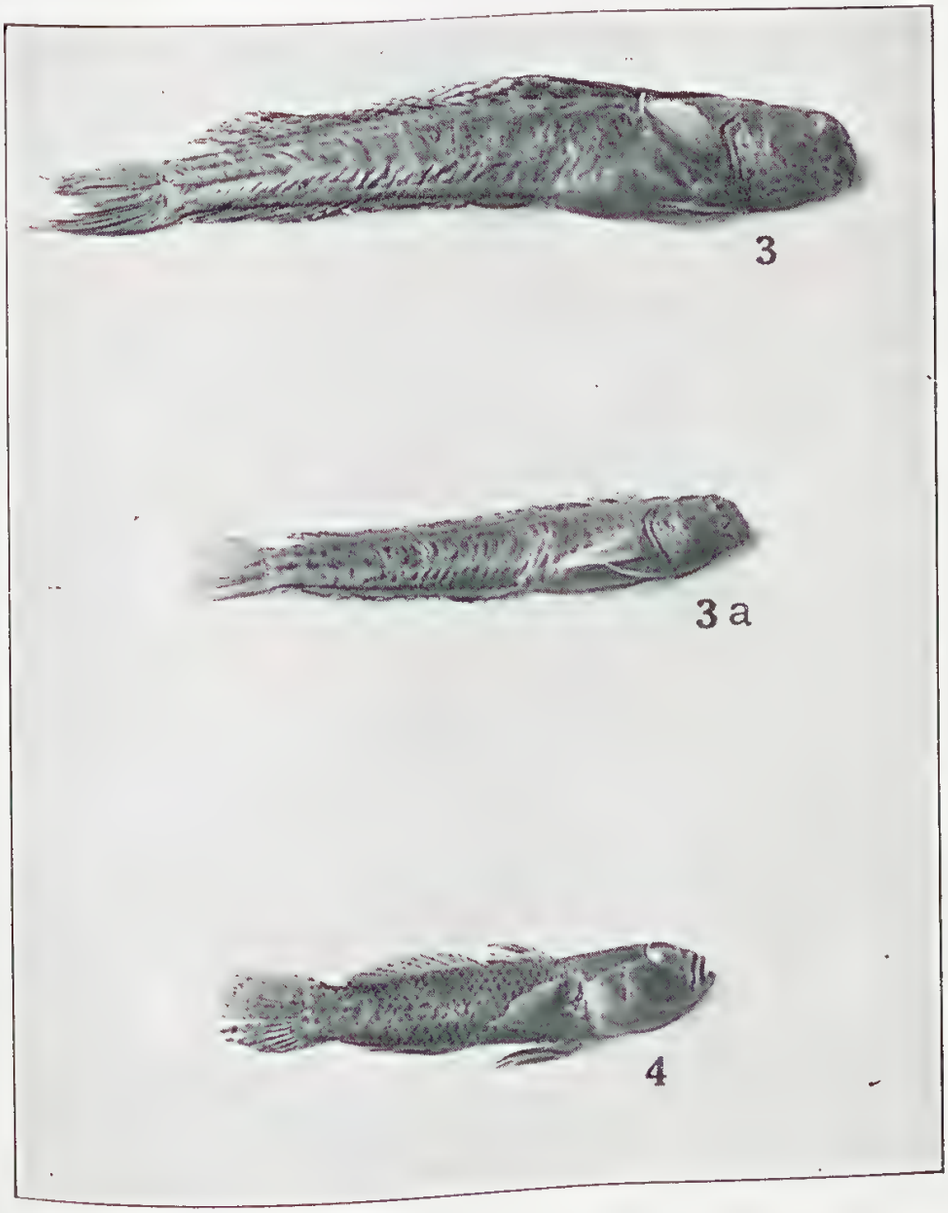

Fig. 3–3a. *Pauloscirtes obliquus* Garman. Fig. 4. *Drombus halei* sp. nov. (Photo, G. C. Clutton).

Body naked, its depth about one-sixth of the standard length. Lateral line reduced to a few pores near the shoulder.

Dorsal fins united, no differentiated anterior portion or produced dorsal rays. More than thirty dorsal rays and less than thirty anal rays. Both of these fins distinct from the caudal. Some of the caudal rays may be produced in large specimens.

Coloration ornate on head, body, and dorsal and anal fins.

At once separable from *Petroscirtes* Rüppell, 1830, by its longer habit, lack of tentacles on head, and lower dorsal fin. *Blennechis* Cuv. & Val. 1836 has the anterior dorsal rays produced and a broad lateral band. *Omobranchus*, of the same authors, has small canines and dorsal fin joined to caudal. *Aspidontus* Quoy and Gaimard, 1835, is conspicuously banded and has the snout pointed. *Graviceps* Fowler, 1903, has only eighteen incisors in each jaw and less elongate form but is closer to the new form than the other genera mentioned. *Cyneichthys* Ogilby, 1910, has an elevated crest on the occiput and some of the dorsal rays filamentous, whilst *Ostreoblennius* Whitley, 1930, differs in having the head less than four in standard length and in its coloration.

PAULOSCIRTES OBLIQUUS (Garman).

Fig. 3-3a.

Petroscirtes obliquus Garman, Bull. Mus. Comp. Zool. Harvard, xxxix, 8, August, 1903, p. 237, pl. iv, fig. 3. Suva, Fiji Is.

Two specimens, 36-52 mm. in standard length, from Flinders Island.

FAMILY GOBIIDAE.

BATHYGOBIUS Bleeker, 1878.

BATHYGOBIUS FUSCUS DARNLEYENSIS (Alleyne and Macleay).

Gobius darnleyensis Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales i, March, 1877, p. 331, pl. xii, fig. 1. Darnley Island, Queensland.

Bathygobius fuscus darnleyensis Whitley, Gt. Barrier Reef Exped. Sci. Rept. iv, 9, Feb. 27, 1932, p. 302.

A series of 24 specimens, 11 to 46 mm. in standard length, from Flinders Island. The largest specimen has lost its left eye, and the empty socket is covered by a skin similar to that of the rest of the head; it appears to be a male.

YONGEICHTHYS Whitley, 1932.

YONGEICHTHYS CRINIGER (Cuv. & Val.).

Gobius criniger Cuvier and Valenciennes, Hist. Nat. Poiss. xii, March, 1937, p. 82. Port Dorey, New Guinea.

Yongeichthys criniger Whitley, Gt. Barrier Reef Exped. Sci. Rept. iv, 9, Feb. 27, 1932, p. 303.

Two young specimens, 22-23 mm. in standard length, from Flinders Island.

ISTIGOBIUS Whitley, 1932.

ISTIGOBIUS STEPHENSONI (Whitley).

Gobius (Istigobius) stephensoni Whitley, Gt. Barrier Reef Exped. Sci. Rept. iv, 9, Feb. 27, 1932, p. 301. Murray Island, Queensland.

Three young specimens, 13·5-23 mm. in standard length, from Flinders Island.

AMBLYGOBIUS Bleeker, 1874.

AMBLYGOBIUS PHALAENA (Cuv. & Val.).

Gobius phalaena Cuvier and Valenciennes, Hist. Nat. Poiss. xii, March, 1837, p. 92. Vanikolo, Santa Cruz Group.

Amblygobius phalaena McCulloch and Ogilby, Rec. Austr. Mus. xii, 10, July 14, 1919, p. 253, pl. xxxv, fig. 1.

Two young specimens, 26-31 mm. in standard length, from Flinders Island.

DROMBUS Jordan and Seale, 1905.

Drombus Jordan and Seale, Proc. U.S. Nat. Mus. xxviii, 1905, p. 797, Orthotype, *D. palackyi* Jordan and Seale.

The typical form of this genus from the Philippine Islands is recalled by the Queensland goby which I name below:

DROMBUS HALEI sp. nov.

Fig. 4-5.

D. vi/11; A. i/8; P. 18; V. 5; about 20 caudal rays. Sc. 28. L. tr. 11. Predorsal scales 19.

Head (10 mm.), 3, depth (6) 5 in standard length. Eye (nearly 3 mm.), 3·3 in head.

Head naked; the cheeks crossed by minute cirriform papillae in rows. No pit, only a shallow groove, over opercles. No crests or barbels. Preoperculum unarmed. Nape and neck scaly. Snout short and obtuse; mouth small, the maxillary reaching to below anterior margin of eye. Lower jaw protruding beyond upper. Bands of simple villiform teeth, with a few enlarged outer ones, on jaws. Behind these, a buccal flap in each jaw. Vomer toothless. Interorbital a very narrow dip between the tumid ocular margins. Gill openings wider than pectoral base, separated by a broad isthmus.

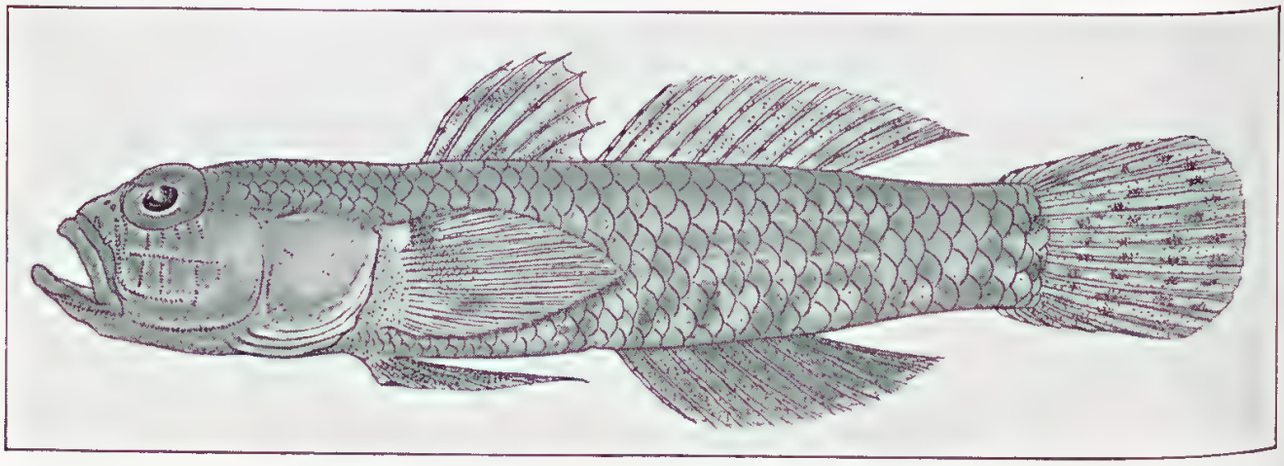

Fig. 5. *Drombus halei* sp. nov., holotype, × 3 (G. P. Whitley, del.).

Size small. Body covered with large ctenoid scales, which extend over the nape and neck to the eyes. Breast and lower part of pectoral base naked.

First dorsal with six spines, none of them stiff or filamentous. Upper pectoral rays not free nor differentiated from the others. Ventrals five-rayed, united, and with a rather deep frenum. Caudal rounded.

Colour in spirits, dark brownish, especially on head and back. Lower part of body lighter brown, crossed by eight or nine obscure darker areas which tend to form chequers with a similar row above them and alternating with them. Eye bluish. Fins white, more or less densely spotted or infuscated with brown or blackish. A yellow spot, followed by a dark smoky wash on bases of upper pectoral rays.

Described and figured from the unique holotype of the species, a specimen 30 mm. in standard length or 1½ inches in total length.

Loc. Flinders Island, North Queensland; caught inshore.

Named in honour of Mr. Herbert M. Hale, Director of the Museum at Adelaide.

FAMILY PERIOPHTHALMIDAE.

EUCHORISTOPUS Gill, 1863.

EUCHORISTOPUS KALOLO (Lesson).

Periophthalmus kalolo Lesson, Voy. Coquille, Zool. ii, 1, 1831, p. 146. Waigiou.
Periophthalmus argentilineatus Cuv. & Val., Hist. Nat. Poiss. xii, March, 1837, p. 191. Waigiou, etc.; same specimens, collected by Lesson and Garnet.
Euchoristopus kalolo Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 325. *Id.* Hale and Tindale, Rec. S. Austr. Mus. v, 1933, p. 110.

Two specimens, 60-65 mm. standard length, from Flinders Island.

FAMILY SCORPAENIDAE.

SEBASTAPISTES Streets, 1877.

SEBASTAPISTES BYNOENSIS LAOTALE Jordan & Seale.

Fig. 1.

Sebastapistes laotale Jordan and Seale, Bull. U.S. Bur. Fish. xxv, 1905 (Dec. 15, 1906), p. 376, fig. 72. Apia, Samoa.

Five specimens, 32-53 mm. in standard length (on right in fig. 1), from Flinders Island are figured beside a series of *Centrogenys* from the same place to show the remarkable superficial resemblance between the two structurally different species.

FAMILY PLATYCEPHALIDAE.

SUGGRUNDUS Whitley, 1930.

SUGGRUNDUS NEMATOPHTHALMUS (Gunther).

Platycephalus nematophthalmus Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 184. Port Essington, North Australia.

One small specimen, 70 mm. in standard length, from Flinders Island.

FAMILY TETRAODONTIDAE.

OVOIDES Anonymous, 1798.

OVOIDES MANILLENSIS VIRGATUS (Richardson).

Tetrodon manillensis Procé, Bull. Soc. Philom. Paris, Sept. 1822, p. 130. Manilla, Philippine Islands.

Tetrodon virgatus Richardson, Zool. Voy. Erebus and Terror, Fish, 1846, p. 62, pl. xxxix, fig. 8-9. Port Jackson, *Id.* Richardson, Zool. Voy. Herald, Verteb. 1854, p. 163, pl. xxviii (Port Jackson and Torres Strait).

One specimen, 147 mm. in standard length, from Bathurst Head, is accompanied by a label, giving the native name as "Adadi", and stating that this fish is *boiled*, being poisonous if roasted in embers in the usual way fish are cooked.

CHELONODON Müller, 1841.

CHELONODON PATOCA (Hamilton-Buchanan).

Tetrodon patoca Hamilton-Buchanan, Fishes of the Ganges, 1822, pp. 7 and 363, pl. xviii, fig. 2. Ganges, India.

Leiodon patoca, Bleeker, Atlas Ichth. v, 1865, p. 76, pl. ccx, fig. 2.

A specimen, 97 mm. in standard length, from Flinders Island, and another, of 44 mm. from Bathurst Head. The fins are orange or yellowish, the caudal being transversed by a diffuse dusky band.

New record for Queensland.

The Australian Museum also possesses a specimen from the Trobriand Islands.

REMARKS ON SOME TYPICAL SPECIMENS OF CHANDIDAE, EXAMINED FOR COMPARISON WITH AMBASSIS TELKARA Whitley (3).

Thanks to the loan of type-specimens by the Queensland Museum, Brisbane, and the Macleay Museum, University of Sydney, I have been enabled to compare microscopically quite a number of Chandidae with authentically named specimens. The following results will form a basis for further research although numerous species from Australia, New Guinea, and Oceania await more detailed treatment.

Some of these Chanda Perches are popular as aquarium pets, and the breeding of the Glass Fish *Ambassis* (= *Chanda*) *lala* Buch.-Ham. has recently been described, whilst in New South Wales and Queensland a popular aquarium species is *Ambassis agassizi* Steindachner (see Carter, The Aquarium (Philadelphia) i, 9, 1933, p. 234, and Ladiges, *ibid.* p. 306). The fact that some Chandidae are marine and others fluviatile indicates that, when the species are better known, their zoogeographical distribution will afford a fascinating subject for study.

Fishermen detest them, as Mr. L. Wilson writes (*in lit.* 1929) of "*Ambassis nalua*" from Port Darwin, where they are known as "Doody"—"Doody is a

(3) See p. 349.

pest, not even good bait. The fins mesh every time it is caught. They are more than plentiful, and are found with all classes of fish (mullet, sardine, etc.), and are always in large shoals. If one is not quick enough to notice the type of fish caught in the net, it takes the best part of an hour to clean your net again''. Indeed, the present writer has collected series of specimens of another species by picking them out of the meshes of nets in northern New South Wales.

The Chandidae are of no commercial value, and Cantor states that they are merely used as manure in Malaya. Their saving grace seems to be their liking for mosquito-larvae as food, and several Australian species have been utilized in attempts to cope with the mosquito pest.

AUSTROCHANDA gen. nov.

Orthotype, *Pseudoambassis macleayi* Castelnau = *Austrochanda macleayi*.

Profile of head, excavated. No teeth on tongue. Supraorbital with but one spine posteriorly. Infraorbital, preorbital, and preopercular serrated. Maxilla not dilated at its extremity. Not more than 10 dorsal and anal rays. Anterior dorsal and anal spines elongate. Recumbent dorsal spine not exposed. Body deep; lateral line incomplete. About a dozen predorsal scales. Caudal pedunele deep.

This new generic name is proposed for *Pseudoambassis* Castelnau (Proc. Linn. Soc. N.S. Wales iii, Sept., 1878, p. 43), preoccupied by *Pseudambassis* Bleeker (Arch. Néerl. Sci. Nat. xi, 2, 1876, p. 292; Genotype *Chanda lala* Buchanan-Hamilton). Bleeker's name is a synonym of *Chanda* Buchanan-Hamilton, as restricted by Fowler (Proc. Acad. Nat. Sci. Philad. 1905, p. 500), a genus having about fifteen anal rays.

AUSTROCHANDA MACLEAYI (Castelnau).

Fig. 6-7.

Pseudoambassis macleayi Castelnau, Proc. Linn. Soc. N.S. Wales iii, Sept. 1878, p. 43. Norman River, Gulf of Carpentaria. Types in Macleay Museum examined.

Pseudoambassis elongatus Castelnau, Proc. Linn. Soc. N.S. Wales iii, Sept. 1878, p. 44. Norman River, Gulf of Carpentaria. Types in Macleay Museum examined.

Ambassis elevatus Macleay, Proc. Linn. Soc. N.S. Wales v, Feb. 1881, p. 338. Endeavour River, Queensland. Types in Macleay Museum examined.

Pseudambassis pallidus De Vis, Proc. Linn. Soc. N.S. Wales ix, Aug. 19, 1884, p. 393. Queensland. Type in Queensland Museum examined and figured.

Pseudambassis convexus De Vis, Proc. Linn. Soc. N.S. Wales ix, Aug. 19, 1884, p. 394. Queensland. Types in Australian and Queensland Museums examined.

Ambassis mulleri Weber, Zool. Forsch. Austr. v, 1895, p. 263. Burnett River, Queensland. Not *A. mulleri* Klunzinger, Sitzb. Ak. Wiss. Wien. lxxx, I, 1879, p. 346, pl. i, fig. 3, from Port Darwin.

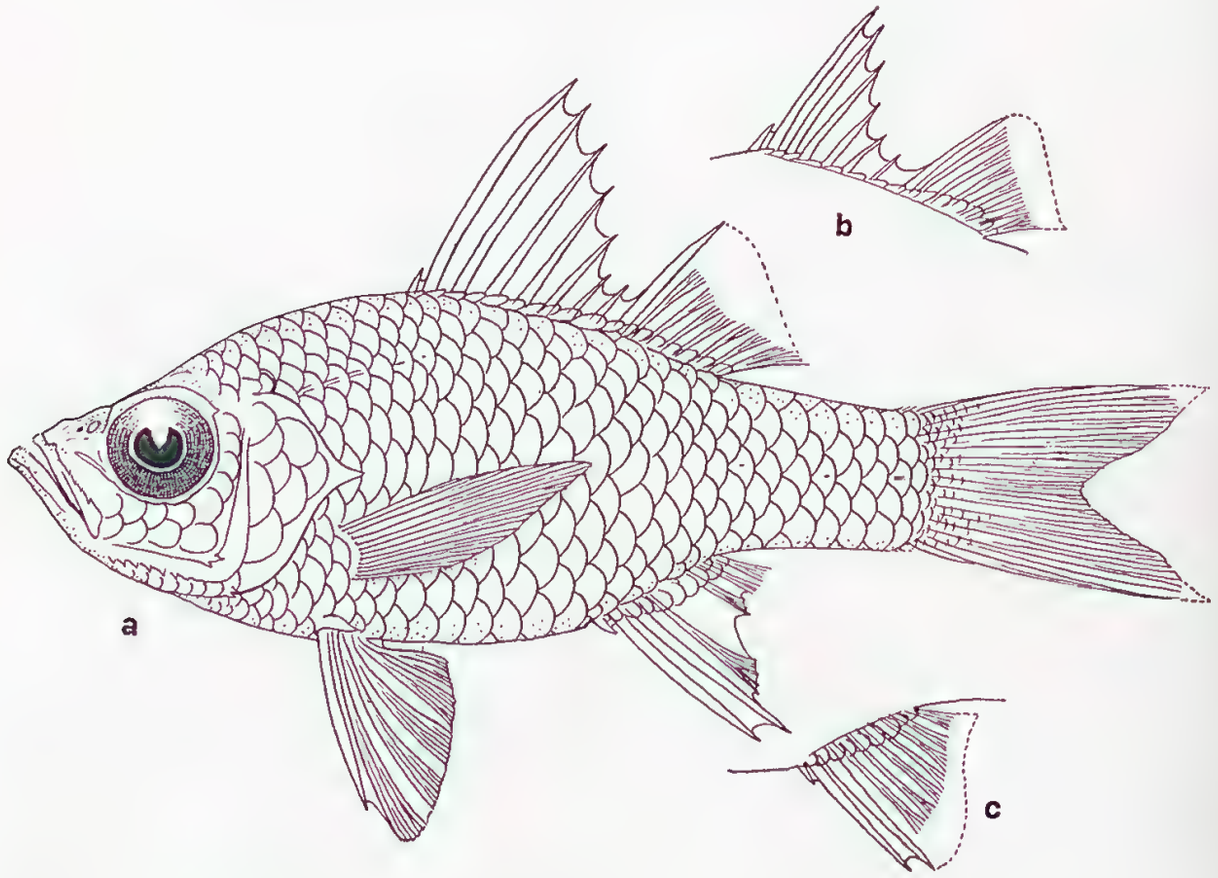

Fig. 6. *Austrochanda macleayi* (Cast.), juv. a, Lectotype of *Pseudoambassis elongatus* Cast.; b and c, dorsal and anal fins of smaller type of *P. elongatus*, × 3 (G. P. Whitley, del.).

There are three specimens of *macleayi* in the Macleay Museum from the Norman River, and the largest, 52 mm. in standard length, is selected as the lectotype of the species. The lateral line is incomplete and the scales are in from 26 to 28 transverse series. The orbital bones are more strongly serrated and the teeth more strongly developed in the type than in the smaller specimens, but all of them have D. vii/i, 10, A. iii/10 and dorsal membranes dusky.

The Macleay Museum has two small specimens of *Pseudoambassis elongatus* Castelnau from the Norman River (fig. 6). These have D. vii-viii/i, 7; A. iii/4 (deformed)-7. A few tubes on the lateral line scales anteriorly. Scales in about

24 to 25 transverse series. L. tr. 11. The depth is about one-third of the standard length, but this is the slenderness natural in young specimens. A most careful comparison wtih *macleayi* makes it evident that the *elongatus* form is merely the young of the species.

Five types of *elevatus*, from the Endeavour River, are also in the Macleay Museum, and agree with those of *macleayi*. The formulae vary a little: D. vii/i, 9-10; A. iii/9-10; Sc. 24-26.

Fig. 7. *Austrochanda macleayi* (Cast.). Type of *Pseudambassis pallidus* De Vis., × 1¾ (G. P. Whitley, del.).

The Queensland Museum has kindly forwarded a specimen which is obviously the type of *pallidus*, and which is here illustrated (fig. 7). It is 50 mm. in standard length. Head 19 mm., eye 6, interorbital 4, snout 3, depth of body 22 mm. Predorsal scales 12. The fin spines and rays appear to be abnormal, being D. vi/ii, 7; A. iii?/8; but it is not unusual for Chandidae, Gerridae, Leiognathidae, and like fishes to have a ray changed into a spine in some individuals.

The types of *P. convexus* De Vis have the upper preopercular ridge not serrated, as in the *elongatus* form, and eight dorsal rays, so *convexus* is apparently another synonym of this species. Thus, I regard *macleayi*, *elongatus*, *elevatus*, *pallidus*, and *convexus* as conspecific.

ACANTHOPERCA Castelnau, 1878.

Acanthoperca Castelnau, Proc. Linn. Soc. N.S. Wales, iii, Sept. 1878, p. 44. Haplotype *A. gulliveri* Castelnau.

Whitleyia Fowler, Bull. U.S. Nat. Mus. 100, x, 1930, pp. 2 and 148. Haplotype *Ambassis wolffi* Bleeker.

Whitleyina Fowler, *ibid.* p. vii, *Errore.*

This genus accommodates certain large forms of Chandidae with about 40 or more scales in the complete lateral line, about four to seven rows of cheek-scales, a large maxilla, and much enlarged dorsal and anal spines, the dorsal spines being higher than the soft dorsal fin. The type of *A. gulliveri* Castelnau, from the Norman River, Gulf of Carpenteria, is preserved in the Macleay Museum. It has D. vii/i, 11; A. iii/9; 1 lat. 38 to hypural, and the procumbent dorsal spine present but concealed. It is evidently conspecific with *Ambassis gigas* Ramsay and Ogilby (Proc. Linn. Soc. N.S. Wales (2) i, 1886, p. 9), the holotype of which, from the Strickland River, New Guinea, is in the Australian Museum. This specimen has 12 dorsal and anal rays, but otherwise agrees in detail with the excellent description and figure of the species given by Weber and Beaufort (Fish. Indo. Austr. Archip. v, 1929, p. 403, fig. 97; see also Weber, Nova Guinea ix, 1913, p. 576, fig. 31).

Apparently, *Whitleyia* is a synonym (or at most a subgenus) of *Acanthoperca.*

NEGAMBASSIS gen. nov.

Orthotype, *Tetracentrum apogonoides* Macleay.

A genus of freshwater Chandidae having four anal spines. Both the dorsal and anal spines are very strong. Procumbent dorsal spine concealed. The head is excavated above, and has several naked areas. Supraorbital forming a spineless ridge. Infraorbital, preorbital, preopercle, and interopercle strongly serrated. Jaws and fine teeth, enlarged anteriorly in upper jaw. Lateral line complete, running over about thirty scales. Size fairly large.

Negambassis replaces *Tetracentrum* Macleay, preocc. in Insecta by Brauer, 1865.

NEGAMBASSIS APOGONOIDES (Macleay).

Fig. 8.

Tetracentrum apogonoides Macleay, Proc. Linn. Soc. N.S. Wales viii, July 17, 1883, p. 256. Goldie River, New Guinea. Cotypes in Aust. Mus. seen. *Id.* Fowler, Mem. Bish. Mus. x, 1928, p. 167. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip. v, 1929, p. 425.

This species is now figured for the first time from the lectotype, the largest of a series of cotypes in the Australian Museum. This specimen is 125 mm. in standard length or about six inches overall. Although superficially like an Apogonid fish, this species is obviously derived from an *Ambassis*-like form. It is rather like *Parambassis* Bleeker, but the four anal spines (constant in all the

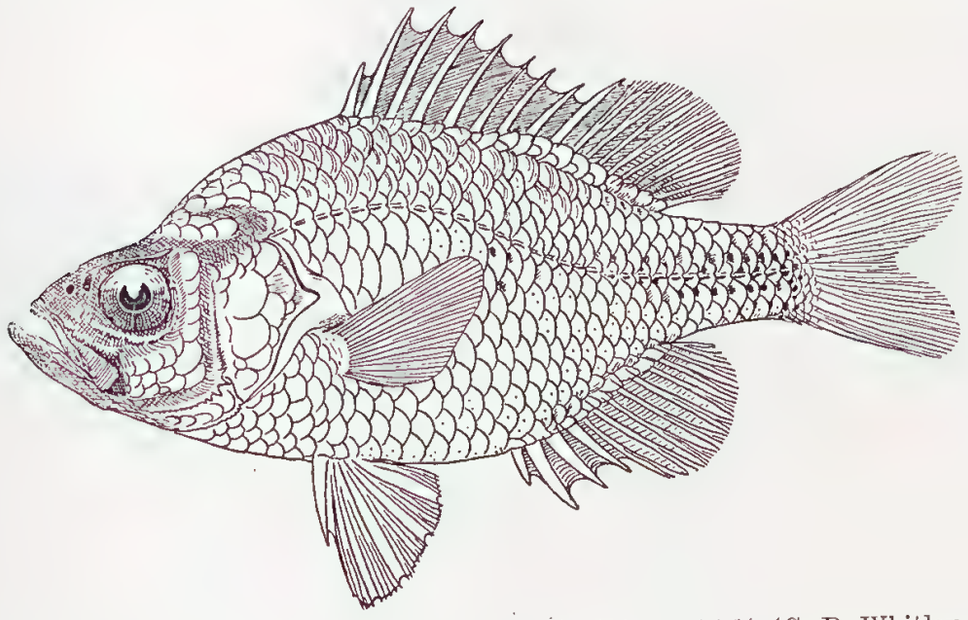

Fig. 8. *Negambassis apogonoides* (Macleay). Lectotype, × ⅔ (G. P. Whitley, del.).

cotypes), the larger scales, and the naked patches on the head serve to distinguish it. There are three or four rows of scales above the lateral line and three rows of cheek-scales. The coloration is now obscure, but the specimens were apparently conspicuously spotted in life.

BLANDOWSKIELLA Iredale and Whitley, 1932.

Blandowskiella Iredale and Whitley, Vict. Nat. xlix, Aug. 8, 1932, p. 95. Orthotype *Pseudoambassis castelnaui* Macleay.

Profile of head not cut by supraorbital, which is not serrated. Preoperculum and preorbital serrated, but other bones of head entire. Maxilla short. About eight dorsal and anal rays. Dorsal and anal spines not very strong. Body compressed, not very deep. Lateral line practically obsolete. Inhabiting freshwater.

BLANDOWSKIELLA CASTELNAUI (Macleay).

Fig. 9.

Pseudoambassis castelnaui Macleay, Proc. Linn. Soc. N.S. Wales v, Feb. 1881, p. 339. Murrumbidgee River, N.S. Wales.

A specimen from the Narrandera district, New South Wales, is here figured. This species was discovered by William von Blandowski in Victoria, but Macleay later published a name for it. In recounting the deeds of Blandowski, Iredale

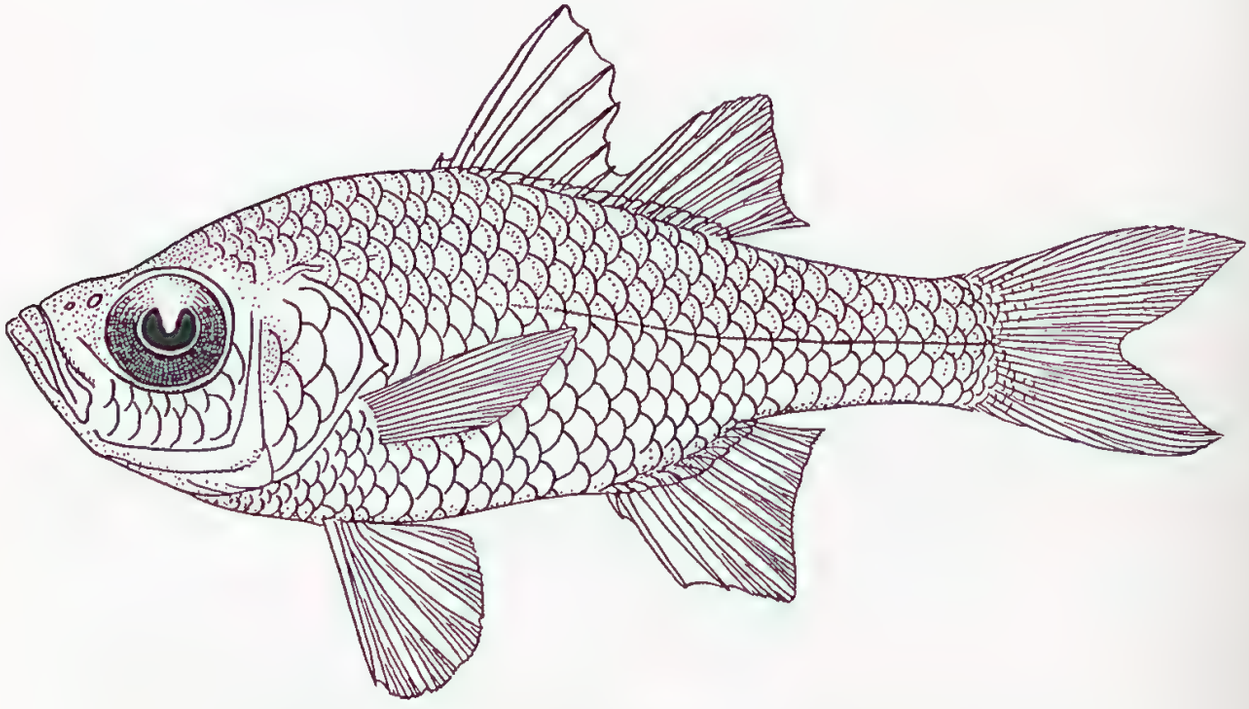

Fig. 9. *Blandowskiella castelnaui* (Macleay). × 2½ (G. P. Whitley, del.).

and Whitley provided a new generic name for this attractive little species. I have also seen Murray River (Victoria) specimens in the National Museum, Melbourne.

AMBASSIS Cuv. and Val., 1828, *sensu lato.*

AMBASSIS PAPUENSIS Alleyne and Macleay.

Fig. 10.

Ambassis papuensis Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales i, Feb. 1877, p. 266, pl. v, fig. 4. Hall Sound, New Guinea. Types in Macleay Museum examined.

There are two co-types of this species in the Macleay Museum, 44 to 47·5 mm. in standard length; the larger specimen is hereby designated the lectotype, and figured.

D. vii/i, 9; A. iii/9; L. lat. 12 + 12 = 24. L. tr. 2/1/7-8.

Eye, 6·5 mm., head 16, depth of body 19, second dorsal spine 12 mm. in larger specimen.

General characters as in *A. telkara* but the nuchal ridge is not serrated; there is only one row of scales on the cheek, and about ten predorsal scales. The second anal spine of *papuensis* is much shorter than the third, and the posterior

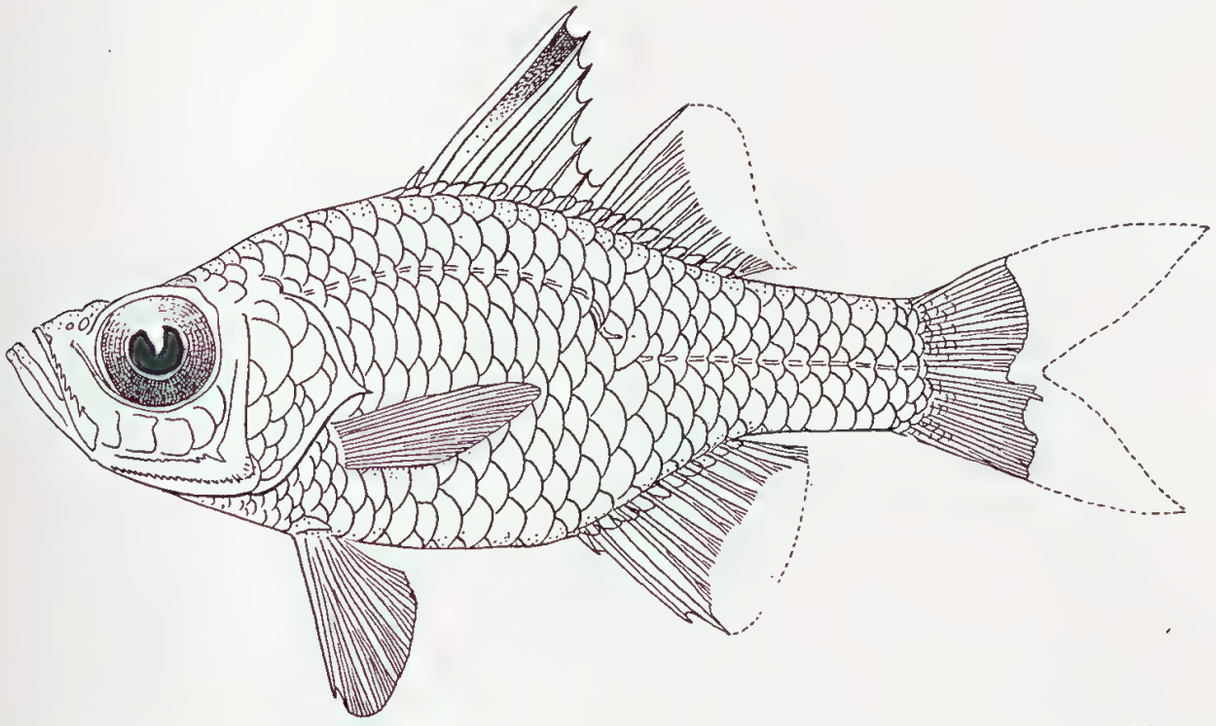

Fig. 10. *Ambassis papuensis* Alleyne & Macleay, lectotype, × 2 (G. P. Whitley, del.).

margins of the preoperculum and interoperculum are not denticulated. Tongue toothless.

Probably both *A. telkara* and *A. papuensis* are subgenerically distinct from the true *Ambassis ambassis* (Lacépède) type of the genus.

AMBASSIS AGASSIZII Steindachner.

Ambassis agassizii Steindachner, Sitzb. Ak. Wiss. Wien lv, I, 1867, p. 9. Fitzroy R., Rockhampton. *Id.* Günther, Ann. Mag. Nat. Hist. (3) xx, 1867, p. 57. Clarence R., N.S.W.

Chanda agassizii Waite, Mem. N.S.W. Nat. Club, i, 1904, p. 29. N.S. Wales.

Priopis nigripinnis Ogilby, Proc. Roy. Soc. Qld. xxiii, Nov. 1910, p. 13. Creeks at Kilcoy, South Queensland.

A diminutive species, up to $2\frac{1}{2}$ inches long, from the rivers of southern Queensland and northern New South Wales. *Priopis nigripinnis* Ogilby (not *Pseudambassis nigripinnis* De Vis) is evidently a synonym of this species as, although Ogilby's types have been lost, his description agrees well with that of Steindachner.

AMBASSIS NIGRIPINNIS (De Vis).

Pseudambassis nigripinnis De Vis, Proc. Linn. Soc. N.S.Wales ix, Aug. 1884, p. 393. Brisbane River, Queensland. Cotypes in Austr. Mus. seen.

Priopis olivaceus Ogilby, Proc. Roy. Soc. Qld. xxiii, Nov. 1910, p. 11. Creeks and waterholes around Brisbane.

One or two tubes on lateral line. *Sc. circa* 25. Two rows of cheek-scales, suborbital serrated; upper preopercular angle with two spines, otherwise not serrated.

Ogilby's species, *olivaceus*, is apparently a synonym of *nigripinnis* De Vis. Ogilby also described a new species under the name *nigripinnis*, but this does not require a new name as it is evidently a synonym of *Ambassis agassizii* Steindachner.

PRIOPIDICHTHYS gen. nov.

Orthotype *Pseudoambassis ramsayi* Macleay = *Priopidichthys marianus* (Günther).

Supraorbital with several spines posteriorly. Preorbital and lower limbs of preoperculum serrated, infraorbital crenulate; other bones of head smooth. Teeth on jaws, vomer, palatines, and tongue. Maxilla moderate. Six or seven dorsal spines and ten to eleven dorsal and anal rays. Lateral line well developed, but interrupted.

PRIOPIDICHTHYS MARIANUS (Günther).

Ambassis marianus Günther, Rept. Voy. Chall., Zool. i, 6, 1880, p. 32. Tiaro, Mary River, Queensland ("Challenger" Exped.).

Pseudoambassis ramsayi Macleay, Proc. Linn. Soc. N.S. Wales, v, 1881, p. 340. Port Jackson. Type in Macleay Mus. seen.

Ambassis commersonii Ogilby, Cat. Fish. N.S. Wales, 1886, p. 14. Richmond River, N.S.W. Not *A. commersonii* Cuv. and Val., 1828, from Bourbon, etc.

Chanda buruensis Waite, Mem. N.S.W. Nat. Club, i, 1904, p. 29 (N.S.W.). Not *Ambassis buruensis* Bleeker Nat. Tydschr. Ned. Ind. xi, 1856, p. 396, from East Indies.

Priopis ramsayi McCulloch, Zool. Res. Endeav. i, 1911, p. 57, pl. xvi, fig. 3 (ref. and synon.).

I am unable to separate *ramsayi* from *marianus* as a distinct species. The lateral line of Nerang Creek (Queensland) specimens caught by Ogilby and Tosh in one haul of the net varied from 9-14 + 0-11. Sc. 2/28-30/8 (*fide* Ogilby MS.). The 10 or 11 dorsal and anal rays are useful features for diagnosing this species, which is marine or estuarine in Eastern Australia.

VELAMBASSIS gen nov.

Orthotype *Pseudoambassis jacksoniensis* Macleay (Proc. Linn. Soc. N.S. Wales v, Feb. 1881, p. 340. Port Jackson) = *Velambassis jacksoniensis.*

Form elongate, the depth more than 3 in standard length. Supraorbital with a spine posteriorly, the preorbital and infraorbital denticulated and the preopercular and interopercular margins serrated. Eye slightly shorter than

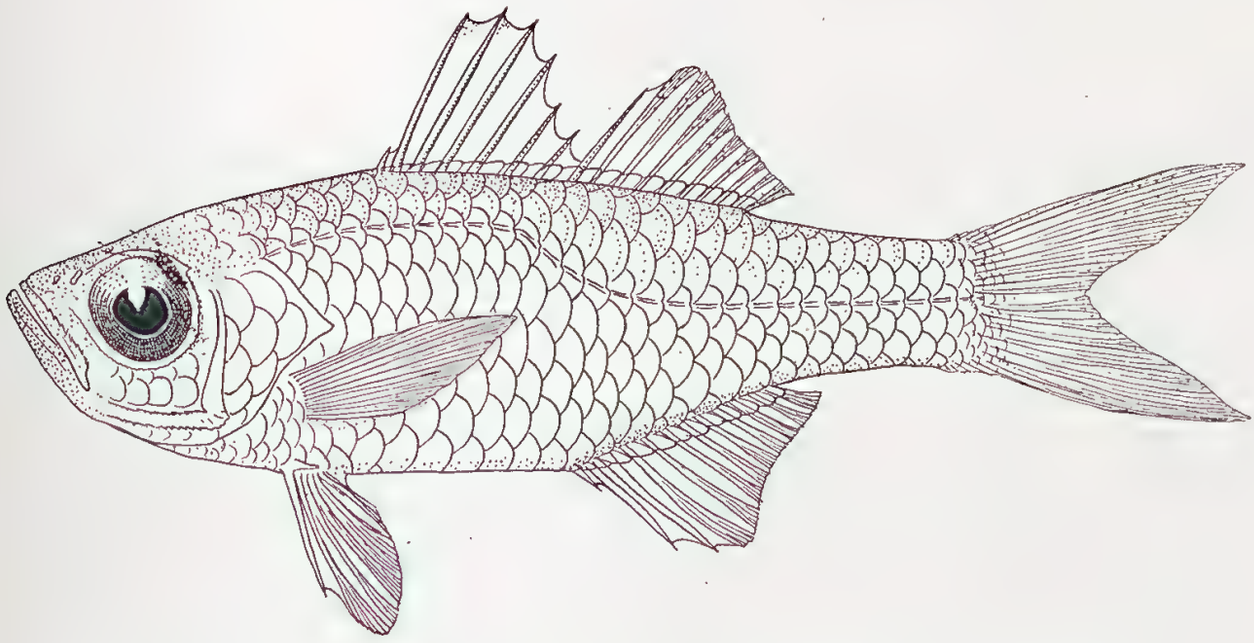

Fig. 11. *Velambassis jacksoniensis* (Macleay). × 2 (G. P. Whitley, del.).

postorbital part of head. Maxillary moderate, just reaching to below anterior portion of eye. Small teeth on jaws and palate; none on tongue. Two rows of cheek scales. Lateral line complete, with about 27 or 28 tubed scales. About 10 to 12 predorsal scales. Procumbent dorsal spine concealed. D. vii/i, 9-10; A. iii, 9. Third dorsal spine longest and much longer than the longest (third) anal spine. The dorsal spines are weaker than is usual in the Chandidae. Back and fins speckled. A specimen of *V. jacksoniensis*, 40 mm. in standard length, is here illustrated (fig. 11). It is one of a series collected at Shellharbour, N.S. Wales, by Mr. F. A. McNeill, Austr. Museum, regd. No. 1A. 6063.

REPTILES AND AMPHIBIANS FROM PRINCESS CHARLOTTE BAY, NORTH QUEENSLAND

By J. R. KINGHORN, C.M.Z.S., Zoologist, Australian Museum.

(By permission of the Trustees of the Australian Museum.)

REPTILIA.

Gehyra variegata, Gray. *Loc.* Bathurst Head.

Diplodactylus vittatus, Gray. *Loc.* Bathurst Head.

Varanus punctatus orientalis, Fry. 370 mm. long. *Loc.* Flinders Island.

Varanus gouldii, Gray. 200-420 mm. long. The most widely distributed of the Australian Varanids. *Loc.* Flinders Island.

Lygosoma (Liolepisma) fuscum, Gray. Transparent palpebral disc not larger than ear opening; 38 scales round body; 35 lamellae under fourth toe. *Loc.* Flinders Island and Bathurst Head.

Lygosoma (Liolepisma) pectorale, De Vis. The prefontals may or may not form a median suture; 32 scales round the body. *Loc.* Flinders Island. 20 specimens.

Lygosoma (Hinulia) tenue, Gray. 2 damaged specimens. *Loc.* Bathurst Head.

Acanthophis antarcticus, Gray. *Loc.* Bathurst Head.

AMPHIBIA.

Hyla caerulea, Gunther. 81 mm. long. Variation from typical—vomerine teeth commencing on a level with front edge of choanae. Finger discs about as large as the tympanum. *Loc.* Stewart River.

Phractops brevipes, Peters. 50 mm. long. *Loc.* Stewart River.

The EGG-CASE of a CAT SHARK, *SCYLIORHINUS VINCENTI* (ZIETZ)

By HERBERT M. HALE, Director, South Australian Museum.

Fig. 1.

Scyliorhinus vincenti (Zeitz).

Scyllium vincenti Zietz, Trans. Roy. Soc. S. Aust., xxxii, 1908, p. 287.
Scyliorhinus vincenti McCull, Endeavour Res., i, 1911, p. 4, pl. ii, fig. 3 and text fig 1.

A female of this species, 410 mm. in length, was caught on September 11th, 1928, in St. Vincent Gulf, South Australia; the ovaries were large, with a number of ova in various stages of development while in the oviducts, ready for deposition, were two eggs. Each of these, including the shell, weighed 0·2 oz.

The chitinous egg-case is subquadrangular in shape, flattened, 52 mm. in length (exclusive of the produced corners), 21 mm. in breadth, and 10·5 mm. in depth. At the posterior end (that is the end directed towards the anus as the egg lay in the oviduct) each corner is produced, tapering rapidly to form a single filament, which is 250 mm. in length, moderately stout basally, and tapering gradually, the hinder (or apical) part being thread-like. When the eggs were removed and placed in a saline solution these filaments rapidly "corkscrewed". The anterior margin of the case is rather thin, and the anterolateral angles are a little produced and curved slightly inwards. Both faces have a striated appearance owing to the presence of adpressed, longitudinal bundles of silk-like threads, laid from end to end and covering practically the whole of the egg-shell. From the lateral parts emanate silky filaments 30 mm. to 40 mm. in length, forming a fringe; at the anterior portion of the case these filaments become very long and form a pair of wavy byssi. Each byssus is 350 mm. in length and is composed of a great number of separate fine threads. In the oviduct the byssi appeared as slender and extremely flexible tendrils, and their structure and purpose were apparent only when the eggs were placed in fluid.

Evidently, when the egg is extruded the posterior tendrils rapidly twist to a spiral and thus anchor the egg to weed or some other support; also, the long byssi, once they have floated free, cling to and entangle around every rough object they come into contact with, like threads of wet silk, and doubtless serve as an excellent secondary means of attachment.

Fig. 1. Egg of *Scyliorhinus vincenti* Zietz. Nat. size.

The CORRELATION of RECENT and FOSSIL TURRITELLIDAE of SOUTHERN AUSTRALIA

By BERNARD C. COTTON, Conchologist, S.A. Museum, and
NELLY HOOPER WOODS, M.A.

Fig. 1-9.

Continual reference has been made to the generic and specific confusion which exists among the *Turritellidae* of Southern Australia, particularly in so far as the fossils are concerned. In this paper an effort is made to clarify some of the problems which have been most acute in the identification of certain species, and to determine the generic or sub-generic location of both the recent and fossil species.

We retain the genus *Turritella*, of which the genotype *T. terebra* is an Australian shell, reducing many so-called genera to sub-generic status. Examination of the genotypes of *Haustator, Gazameda,* and *Maoricolpus* has led us to regard the latter two as distinct sub-genera of *Turritella* and not as synonyms of *Haustator* as Thiele (1) has suggested.

Our grateful thanks are due to Dr. H. J. Finlay, whose notes first gave the impetus to the preparation of this paper; to Mr. F. A. Singleton for the very generous loan of material from his collection and notes he had prepared; and to Mr. F. Chapman and Miss I. Crespin for permission to examine material in the Commonwealth Palaeontological Collection.

Turritella Lamarck 1799.

Only one species of *Turritella* s.s., *Turritella terebra,* the genotype (by monotypy), occurs in Australia, and this species was included by Hedley (2), in his list of Western Australian mollusca. We now describe a distinct subspecies:

T. terebra occidua subsp. nov.

Shell turreted, fairly thin; whorls ventricose; spirals regular but weak, with intermediate finer spiral lirae; suture linear, aperture rotund. Growth striae very fine and regular, corresponding to the concave outer lip of aperture. Colour varying from light to medium brown, occasionally axially flamed with white.

(1) Handbuch der Systematischen Weichtierkunde, Erster Tiel, 1929, p. 181.
(2) Hedley, Mollusca of Western Australia, Roy. Soc., W. Aust., i, 1916, p. 1.

Holotype. Length 22 mm., width 6 mm. King George's Sound, 12-14 fathoms. Reg. No. D. 11439 S.A. Museum. Also from King George's Sound, 28 fathoms. Hopetoun 35 fathoms.

All specimens examined are broken, including the holotype, which if complete, would be of greater length.

KIMBERIA subgen. nov.

Shell with no outer lip sinus, a three-whorled apex and spiral cords with or without a carina.

Type. *Turritella kimberi* Verco.

T. neptunensis Verco and probably *T. microscopica* May should be placed here.

The three species are related to the New Zealand *T.* (*Eglisia*) *planostoma* Hutton, ([3]) which Finlay ([4]) has referred to *accisa*, but this has a different apex and base. They are certainly not *T.* (*Stiracolpus*) Finlay with its marked sinus and one-whorled apex, but seem to form a distinct group recalling the true tropical *Turritella* which is a large shell, *Kimberia* being very small.

MAORICOLPUS Finlay.

TURRITELLA MURRAYANA Tate.

Torcula murrayana Tate, Proc. Roy. Soc., Tas., 1884, p. 227.
Turritella murrayana Tate, Trans. Roy. Soc., S. Aust., xvii, p. 340, pl. viii, fig. 3.

In his original description, though the name is suggestive, Tate has not made the locality of the type clear. However, he has distinctly marked as type a tablet of specimens from the River Murray Cliffs. From measurements, the central shell on the tablet (in the Tate Museum Collection) is the holotype, of which a considerable portion of the apex is missing, and the length of 60 mm. is that of the shell as it remains without the initial 4 or 5 whorls which would contribute at least 5 mm. in additional length.

There are two distinct species which have been classified under *T. murrayana*. Since both the slender and the stout forms occur together at several localities, notably Table Cape and Mornington, we deem it advisable to describe the stout form as a new species. The holotype of *murrayana* is of the slender variety, and the slightly more slender shells occurring at Shelford are readily associated

([3]) Trans. N.Z. Inst., xvii, 1885, p. 320, pl. xviii, fig. 19.

([4]) Trans. N.Z. Inst., lx, 1929, p. 41.

with the Murray examples. The true *murrayana* is found, though rarely, at Table Cape, and it does appear to grow to the extremely large size of the stouter species. Two of the shells on Tate's block of Table Cape specimens are *murrayana*, the rest are the gross form.

An Upper Pliocene development of *T. murrayana* is found in the Abattoirs Boré, Adelaide, which is here described as a new subspecies.

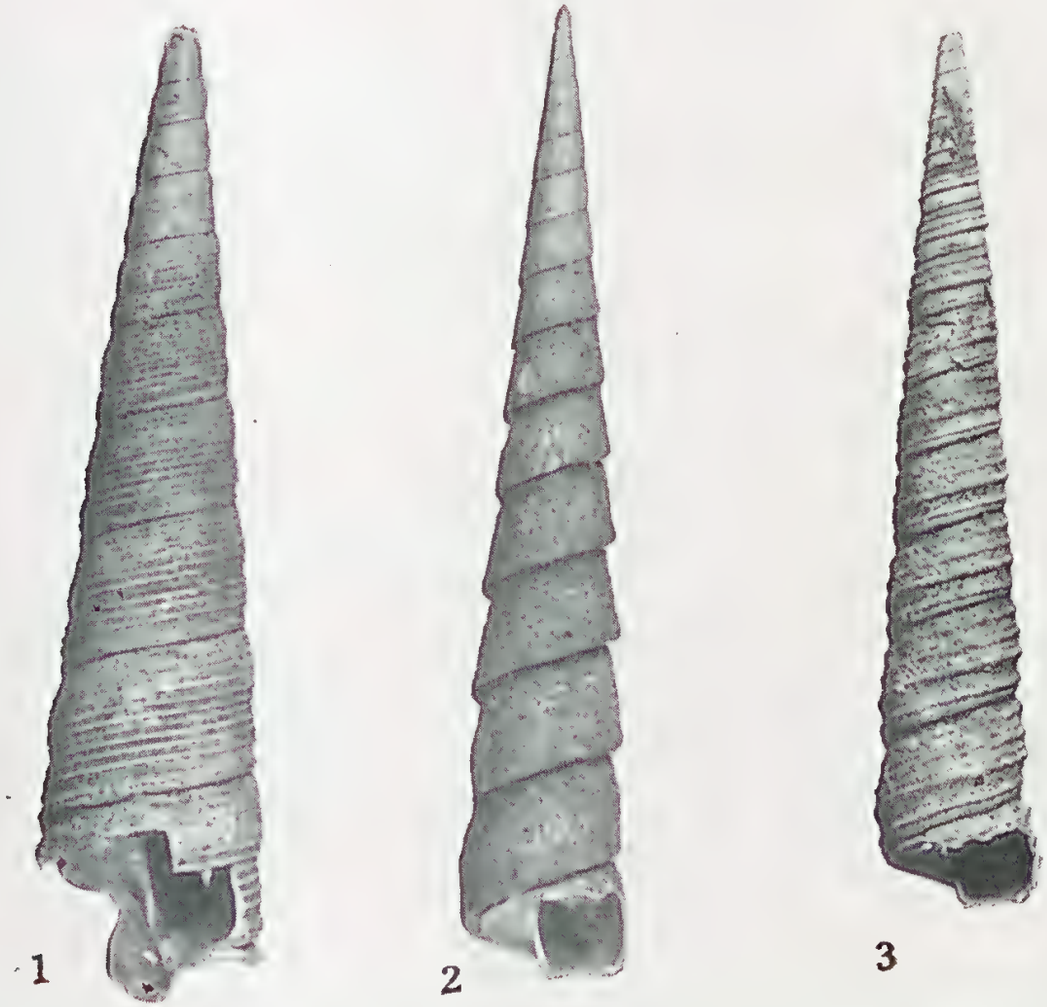

Fig. 1. *Turritella murrayana subrudis* subsp. nov. (× 1·9). Fig. 2. *Turritella acricula adelaidensis* subsp. nov. (× 2·6). Fig. 3. *Turritella subacricula* sp. nov. (× 2·2).

TURRITELLA MURRAYANA SUBRUDIS subsp. nov.

Shell having general characteristics of *T. murrayana;* apical angle 15°; but possessing much flatter whorls, less inflation in the early whorls and less carination at the anterior suture; very strong, coarse spiral sculpture.

Holotype, of which the early whorls are broken. Length 49 mm., width 12 mm. Abattoirs Bore 300-500 ft. (Upper Pliocene). Tate Mus. Coll.

TURRITELLA LATISSIMA sp. nov.

Torcula murrayana var. Tate, Proc. Roy. Soc., Tas., 1884, p. 227.
Turritella murrayana var. Tate, Trans. Roy. Soc., S. Aust., xvii, p. 340.

Shell stout, turreted, apical angle 21°. Protoconch absent, ten whorls remaining, first whorls inflated, later medially slightly concave. Sculpture consists of 24 even, spiral, thread-like ribs crossed by evenly-developed growth lines. Aperture broken, apparently sub-quadrate with fairly deep sinus indicated by lines of growth.

Holotype. Length 65 mm., width 21·5 mm. Table Cape, Lower Miocene.

Remarks: The difference in apical angle and the less strongly developed carination at the anterior border make this species easy to separate from *T. murrayana*. Specimens from Mornington show early whorls very convex, later whorls only slightly flattened, surface sculpture of about 14 threads with growth lines less prominently developed.

A gerontic specimen from Table Cape has measurements: length 82 mm., width 28 mm.

STIRACOLPUS Finlay.

T. (*Stiracolpus*) Finlay 1926 includes the Australian *T. godeffroyana* Donald, *T. smithiana* Donald, *T. atkinsoni* Tate and May, and the closely-allied *T. medioanguiata* Verco; in New Zealand *Stiracolpus* seems to be directly derived from *Zeacolpus* as a late Pliocene offshoot, so that it is doubtful whether any Australian shells belong to it. Certainly no other Australian species than these four could be located there. For the present, *Stiracolpus* must be admitted as common to the Commonwealth and Dominion.

GAZAMEDA Iredale 1924.

Distinguished by the long spire, narrow spire angle, and frequent carination in the anterior suture, flatly convex base with rounded periphery, *Gazameda* includes *T. gunnii* Reeve (genotype), *T. septifraga* Tate, *T. acricula* Tate, *T. subacricula* sp. nov., *T. tasmanica* Reeve, *G. iredalei* Finlay, and *T. multicincturalis* Chapman and Crespin.

These represent the *Zeacolpus* of New Zealand, having a similar apex and sculpture variations (the sudden straight spire margins are peculiar to some species of *Gazameda* and foreign to *Zeacolpus* with its notably convex whorls with deep sutures for a long way down the spire, though adult whorls are flattish), though the protoconch is more regularly coiled and smaller.

There is no relation, as has been suggested by Cotton and Godfrey (5) between *Stiracolpus* Finlay and *G. iredalei* Finlay. The development of two strong keels in that species appears to be foreign to *Gazameda*, but is paralleled in *Zeacolpus* by *Z. fulminata* Hutton, while *T. pagoda* Reeve and *T. ahiparana* Powell have only one strong keel, yet all are easily connected with *T. vittata* Hutton, and obviously recent offshoots from it. It is well known that the strong keels develop sporadically in many groups of *Turritellidae*. It appears then that *G. iredalei* Finlay represents exactly the same offshoot from *Gazameda* that *T. fulminata* is from typical *Zeacolpus*. The apical development of *G. iredalei* does not seem to differ much from that of *T. tasmanica* Reeve as indeed Verco (6) stated, and is unlike that of *T. symmetrica* Hutton. The *Gazameda* series outlined here also differs notably from *Zeacolpus* in the shape of the aperture and the flatly convex base with rounded periphery.

TURRITELLA ACRICULA Tate.

Turritella acricula Tate, Trans. Roy. Soc. S. Aust., xvii, p. 339, pl. viii, fig. 4, pl. ix, fig. 4, 7, 12.

This species, while it has not presented the difficulties in identification experienced with other species of *Turritella*, is a very puzzling one in view of the striking variations in specimens from different localities. So marked are these peculiarities that at times one is tempted to conclude that none of the shells from other localities are conspecific with the holotype from the Murray Cliffs. The species as a whole is also so closely related to *T. tasmanica* Reeve (= *T. subsquamosa* Dkr., = *T. acuta* T. Woods, etc.) that it is with difficulty that one decides whether some of the Victorian and Tasmanian shells are more closely related to the South Australian fossil species than to the recent *T. tasmanica*.

The holotype is undoubtedly a distinct species from the recent shell; it is, as Tate says, relatively narrower; it is more flattened in the whorls and much more acuminately turreted, while the tendency is to become more separate at the suture as the shell advances in age. We therefore advise the retaining of the fossil species *T. acricula* as distinct.

The position of the Victorian and Tasmanian shells is then to be decided. It is obviously unwise to make decisions on the evidence of isolated shells bearing a more striking resemblance to one species than to the other, in view of the fact that the Tertiary species is probably an ancestor of the recent. We have therefore endeavoured to obtain an average of the specimens under our observation from the Tate Collection and that of Mr. F. A. Singleton. The accompanying table is the result of our calculations.

(5) S.A. Nat., xii (iv), p. 59, pl. 2, fig. 4.
(6) *Trans. Roy. Soc., S. Aust.*, xxxiv, 1910, p. 119.

TABLE SHOWING COMPARISON OF SUBSPECIES OF *TURRITELLA ACRICULA*.

Shell.	Locality.	Age.	Average Length in mm.	Average Width in mm.	Average Index $\frac{L}{W}$	Thickness of Shell.	No. of Spiral Ribs (penultimate whorl) Major	Minor	Remarks.
T. (Gazameda) acricula acricula	River Murray Cliffs	Lower Miocene	31	5·9	5·22	Moderately thick	5 (holotype) 2 3	6 7 8	Very turreted. Flattened whorls separate at suture in most adult shells.
T. (Gazameda) acricula adelaidensis	Abattoirs Bore	Upper Pliocene	30·6	6·2	4·61	Moderately thick	About 12, the medial ribs stronger generally than others.		Growth lines almost as strong as ribs, giving latticed appearance. Frequently very excavate at suture.
T. (Gazameda) acricula adelaidensis	Hallett's Cove	Upper Pliocene	30	6·5	4·51	Thick	1 0	If any, cannot be seen.	Thick, badly preserved shells.
T. (Gazameda) acricula victoriensis	Muddy Creek	Lower Miocene	24·3	5·6	4·34	Thin	0 1	c. 17 lirae	Thin, fairly smooth shells convex in early whorls.
T. (Gazameda) acricula victoriensis	Gippsland	Lower Pliocene	24·4	5·6	4·30	Fairly thick	3 2 0	Very variable most specimens presenting a pitted surface.	A great variety of ornamentation presented here. The typical spm. is strongly keeled and excavate at the suture.
T. (Gazameda) acricula victoriensis	Gelibrand River	Lower Miocene	23	5·4	4·25	Thin	0	c. 17	Similar to Muddy Creek.
T. (Gazameda) acricula tasmaniensis	Table Cape	Lower Miocene	36	8·5	4·23	Fairly thick	9 11 6	11 7 19	Fairly evenly sculptured, large, stout shells with major ribs numerous and evenly spaced.
T. (Gazameda) acricula victoriensis	Mornington	Balcombian	20·5	5·5	3·72	Thin	1 at suture	11 16	Much more convex, particularly in early whorls.

In general, the fossil specimens, where the protocouch and the early whorls can be seen, presents a stronger carination in the early whorls than the recent species, though the protoconchs are identical. The recent shell attains a greater size than the fossil, from which it appears to be a development. The Victorian representatives, from Muddy Creek and Mornington particularly, are distinct from those of other localities in the strong convexity of the whorls, particularly the early whorls. This is never developed in the Murray Cliffs series. The Victorian shells are far less attenuated, with a wider spire angle and less prominent sculpture, keels being absent for the most part. Those from Gippsland show characteristics midway between the two species; they are probably the strongest evidence for the development of *tasmanica* from *acricula.*

Table Cape specimens are strikingly stouter with more even, strongly developed lirae on the whorls.

Differences are presented also by specimens from the Abattoirs Bore, Adelaide.

We are therefore of the opinion that all the fossil specimens should be included in the species *T. acricula,* but that only those from the type locality, Murray Cliffs, are true *acricula*; the others we consider subspecies. The Victorian subspecies *T. acricula victoriensis* subsp. nov. is characterized by its less attenuated appearance and its convex whorls; the Tasmanian subspecies, *T. acricula tasmaniensis* subsp. nov. by its stouter size and more even and strongly lirate sculpture; for lack of better material we include the Hallett's Cove specimens with the Abattoirs Bore specimens, which are characteristic of the "grey-sand" bed passed through by many of the bores penetrating a depth of 300-500 feet in the neighbourhood of Adelaide. For this new subspecies possessing stout shell and strong tendency to excavation of the suture and bold sculpture, which is rather latticed, and not lirate we propose the name *T. acricula adelaidensis* subsp. nov.

It is obvious, then, that our division of subspecies is a geographical one only, made on the average characteristics exhibited by the shells from different localities. This seems the most likely division to prevent an endless confusion between the fossil and recent species.

DESCRIPTION OF SUBSPECIES OF *TURRITELLA ACRICULA* TATE.

1. *T. acricula acricula* Tate.

T. acricula Tate, Trans. Roy. Soc., S. Aust., xvii, p. 339, pl. viii, fig. 4.
Holotype. River Murray Cliffs. Tate Mus. Coll.

2. *T. acricula adelaidensis* subsp. nov.

Differs from *T. acricula s.s.* in having slightly more convex whorls, strong growth lines, and about 12 evenly-spaced and even-sized major ribs, giving a latticed appearance to the shell. Decidedly excavate at the suture.

Holotype. Length 37 mm., width 7 mm. Abattoirs Bore, 300-500 ft. Upper Pliocene. Tate Mus. Coll.

3. *T. acricula victoriensis* subsp. nov.

T. acricula var. Tate, Trans. Roy. Soc. S. Aust., xvii, p. 340, pl. ix, figs. 4, 7.

Holotype. Length 25 mm., width 5·5 mm. Gelibrand River, Lower Miocene. Tate Mus. Coll.

4. *T. acricula tasmaniensis* subsp. nov.

T. acricula var. Tate, Trans. Roy. Soc., S. Aust., xvii, p. 340, pl. ix, fig. 12.

Holotype. Length 34 mm., width 8·3 mm. Table Cape, Lower Miocene. Tate Mus. Coll.

TURRITELLA SUBACRICULA sp. nov.

Shell of medium size, sharply turreted, whorls convex, 14 whorls—protoconch missing. Sculptured with 4 major spiral ribs and indistinct secondary ribs crossed by marked axial striae of growth. Aperture strongly notched and quadrate. Columella straight; suture slightly impressed. Base finely spirally lirate and radially striate.

Holotype. Length 40·5 mm., width 7·8 mm. Abattoirs Bore 300-500 ft., Upper Pliocene. Tate Mus. Coll.

This shell is nearest to *T. (G.) acricula*, but differs greatly in the shape of the whorls and the strong sculpture.

CTENOCOLPUS Iredale 1925.

In *T. (Ctenocolpus)*, genotype *T. (C.) australis* Lam., of which the subspecies *T. (C.) australis diffidens* Iredale seems scarcely separable from the species, should be placed *T. pagodula* Tate, *T. terebellata* Tate (noted as being like *T. pagodula*, but with the anterior keel nodulose; this together with the locality seems to validate the species), *T. curialis* Hedley, *T. joannae* Hedley, *T. mediocatilis* Chapman & Crespin, *T. gemmulata* Tate, *T. (C.) trilix* sp. nov., *T. warburtonii* T.-Wds., and *T. sturtii* T.-Wds.

TURRITELLA TRILIX sp. nov.

Shell small, acutely turreted, whorls flattened, suture slightly impressed. Whorls 10. Sculpture of 3 distinct major spiral ribs with wide, smooth interspaces; indistinct subsutural spiral between posterior major rib and suture. Aperture subquadrate; columella straight. Base finely spirally threaded. Protoconch of $1\frac{1}{2}$ turns, smooth and oblique.

Holotype. Length 6·5 mm., width 2·5 mm. Abattoirs Bore 300-500 ft., Upper Pliocene. Tate Mus. Coll. Fairly numerous in bore.

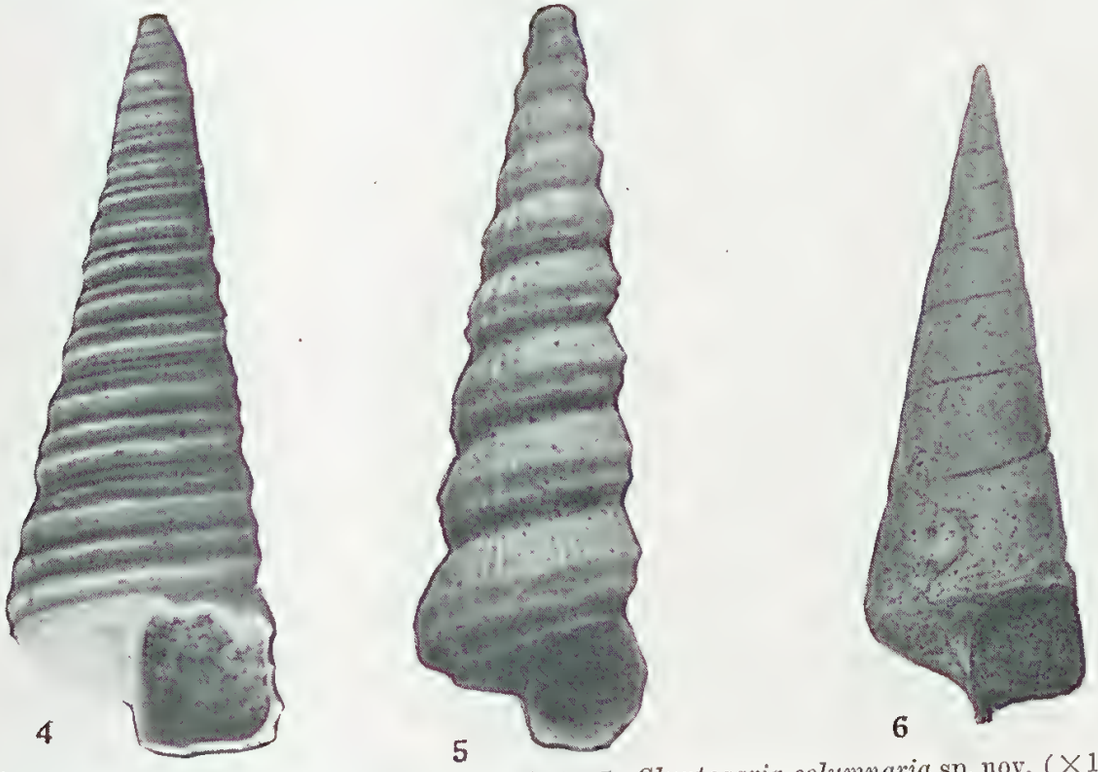

Fig. 4. *Turritella trilix* sp. nov. (× 11·3). Fig. 5. *Glyptozaria columnaria* sp. nov. (×16·7).
Fig. 6. *Turritella latissima* sp. nov. (nat. size).

TURRITELLA WARBURTONII Tenison-Woods.

Tenison-Woods, Proc. Roy. Soc. Tas. 1876, p. 99.
Tate, Trans, Roy. Soc., S. Aust., xvii, p. 337, pl. viii, fig. 2.

TURRITELLA STURTII Tenison-Woods.

Tenison-Woods, Proc. Roy. Soc. Tas. 1876, p. 99.
Tate, Trans. Roy. Soc., S. Aust., xvii, p. 338, pl. viii, fig. 6.

These two species are separable with some difficulty, and Pritchard has suggested (7) that the names are synonymous. To us, however, the differences are striking enough to warrant the retention of both species as distinct. Tate's redescription of Woods's species raises some doubt as to whether he had correctly

(7) Proc. Roy. Soc., Vic., viii, n.s., pp. 113-114.

identified the species with which he was dealing, but after careful examination of the tablets in the Tate collection, and specimens from the collection of Mr. F. A. Singleton, we conclude that certain features pointed out in both descriptions should be more closely adhered to than other less uniform characteristics.

Tate has on his tablet a small shell of *T. warburtonii* marked "like type" from which we conclude that Tate had seen the type and selected a topotype as near to the holotype as possible. His own description is of a more adult shell. We take this to confirm our decision that Tate is not describing a different shell

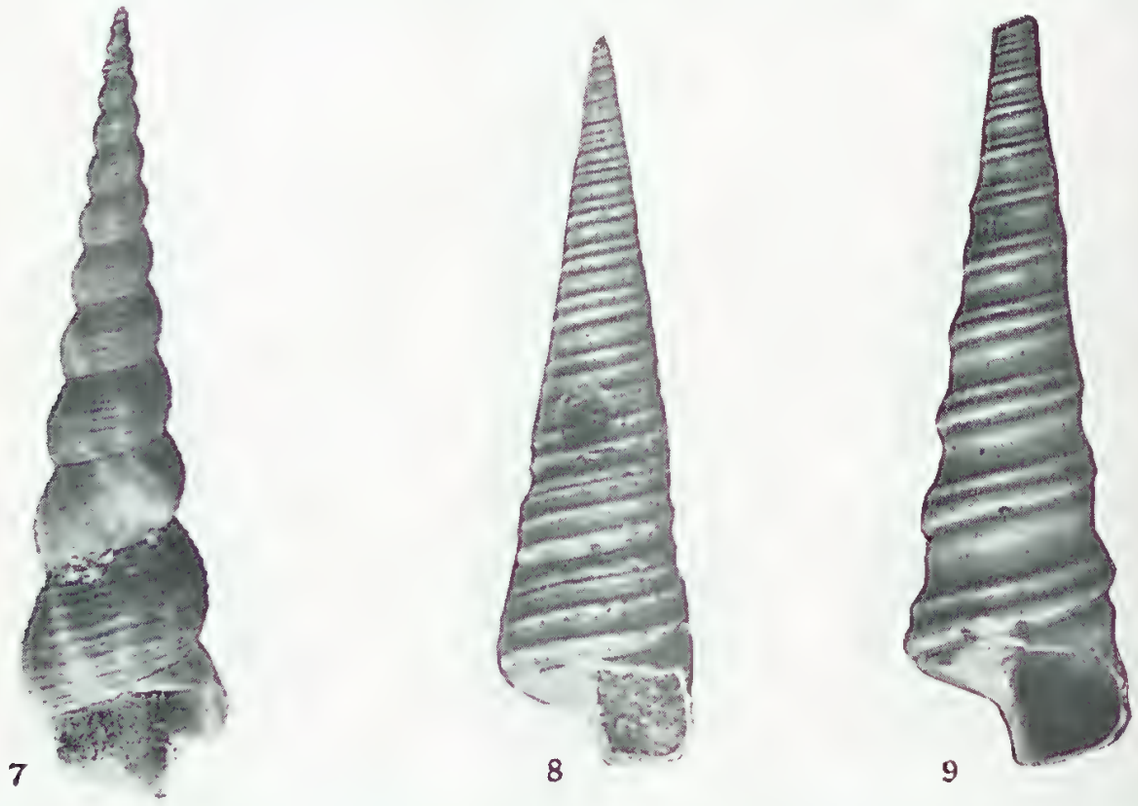

Fig. 7. *Turritella terebra occidua* subsp. nov. (× 3·5). Fig. 8. *Turritella sturtii* Tenison Woods (× 5·9). Fig. 9. *Turritella warburtonii* Tenison Woods (× 6).

when he mentions "two anterior ribs more or less granulose", though Tenison-Woods emphasized that there were "two *smooth* conspicuous ribs at the lower part of each whorl"; in the juvenile shells the ribs are less granulose, and may be even smooth though an obscure (certainly not strong) granulation develops later.

The main features that distinguish the two shells are these; we merely stress what has been already described by Tenison-Woods and Tate:

T. warburtonii is narrowly pyramidal, *T. sturtii* acutely so.

T. warburtonii is characterized by the strong development of two ribs in the anterior portion of each whorl—in the best-developed specimens, these ribs are keel-like, giving an almost pagodoid appearance to the shell.

T. warburtonii has a distinct constriction, a concavity in the most strongly-developed specimens, in the posterio-medial part of the whorl; this is presumably the flattening of Tenison-Woods's description.

While some of the examples from Mr. Singleton's collection show tendencies mid-way between the two species, by paying close attention to the shape of the shell and the development of the anterior ribs, we have without hesitation placed them in one or the other of the species.

The following remarks are extracts from Mr. Singleton's own notes, very kindly offered to us, and our comments upon the specimens under observation. Mr. Singleton's note precedes ours in each case, and the numbers are those from his catalogue:

No. 478—Two smooth ribs and finer lirae. From Lower or "*Crassatella*" bed.

In spite of their apparent *warburtonii* characteristics we place these acutely pyramidal shells, lacking in strong keel-like development, in *T. sturtii.*

No. 479—2 strong, 2 small ribs, former granulose.

These shells resemble both species in some ways, but are sufficiently strong in the anterior ribs and have sufficient posterio-medial constriction to place them in *T. warburtonii.*

No. 480—5-6 ribs, of which median 2-3 granulose.

These are *T. sturtii.*

No. 481—2 ribs, anterior and median, latter granulose, plus lirae.

These are *T. warburtonii.*

No. 482—2 granulose ribs, plus lirae.

These are *T. warburtonii.*

No. 483—2 anterior, very prominent ribs, second slightly granulose, close together, posterior lirate, concave.

These are *T. warburtonii.*

No. 484—2 anterior granulose ribs, weak rib posteriorly.

These are *T. warburtonii.*

No. 485—3 ribs, 2 anterior granulose, third a keel anterior to suture, plus lirae.

These are separable into the two species; 3 specimens lacking strong ribs in the anterior portion we place in *T. sturtii*, the remainder with keel-like outline we assign to *T. warburtonii.*

No. 486—3 ribs, 2 anterior granulose, plus lirae.

Two ribs are so much more strongly developed than the third, which is situated close to the posterior border, and the general outline of the shell place them in *warburtonii.*

Nos. 479-486 are from Upper or "Turritella" bed.

A perusal of these notes convinces one of the almost complete coincidence between Mr. Singleton's notes and our division; all the shells, with the exception of 478, which has weaker, more widely-spaced ribs, that have 2 prominent ribs, fall into *T. warburtonii*; all those more than 2 ribs, except where the anterior pair are very strongly developed, go into *T. sturtii*.

COLPOSPIRA Donald 1900.

In this sub-genus are included *T. runcinata* Watson (genotype), *T. sinuata* Reeve, *T. cordismei* Watson, *T. accisa* Watson, *T. aldingae* Tate, *T. conspicabilis* Tate, *T. tristira* Tate, *T. acinella* Chapman and Crespin, *T. platyspira*, T.-Wds.

TURRITELLA ACCISA Watson.

This species has been correctly recorded by Watson (8), May (9), Verco (10), and Cotton and Godfrey (11) from Bass Strait, South Australia, and Tasmania, all from depths of 38-200 fathoms, and specimens we have examined are typical and distinct from *T. runcinata* occurring in the same localities.

Among the specimens from 100 fathoms off Cape Pillar in the May Collection is a typical specimen of *T. runcinata* which can therefore be added to the Tasmanian list.

TURRITELLA TRISTIRA Tate.

T. tristira Tate, Proc. Roy. Soc., Tas., 1884, p. 227.
T. tristira Tate, Trans. Roy. Soc., S. Aust., xvii (iv), p. 338-339, pl. viii, fig. 8; pl. x, fig. 3.

Some difficulty has been experienced in the differentiation of *T. tristira* from *T. conspicabilis*. The two species exhibit characteristics so closely approximating that unless some rigid distinguishing feature is selected, this difficulty will always arise so long as the two are considered separate species.

The holotype is a Table Cape shell in the Tate Museum Collection, and is, in our opinion, the only one in the collection that can be accurately related to the species. All other specimens on the tablet marked *Turritella tristira* we consider would be better classified under *T. conspicabilis*. On examining the tablets in the Tate Collection one cannot help noticing the apparent indifference with which he separates the two.

(8) Journ. Linn. Soc., Zool., xv, 188, p. 220.
(9) Check list of Mollusca of Tasmania, 1921, p. 60.
(10) Trans. Roy. Soc., S. Aust., xxxiv, 1910, pp. 122-123.
(11) S. Aust. Nat., xii, (iv), August, 1931, p. 57.

There are, however, sufficient specimens available, one from the collection of Mr. F. A. Singleton taken at Jemmy's Point, Kalimna, and many which one of us (N.H.W.) has seen in the collection of the Commonwealth Palaeontologist, taken from various borings in the Gippsland area, to justify the retention of the species. In all cases, the characteristic keeling is continued in every whorl towards the apex. The holotype, so far as can be seen, for the early whorls are missing, exhibits this feature, which makes any similar specimens easily recognizable from *T. conspicabilis.*

We therefore recommend the use of *Turritella tristira* only for those examples in which the development of three even keels is regularly produced throughout the whole of the shell. This is in full agreement with Tate's original description:

"Shell acuminately turreted; apical angle about 15° of upwards of 12 slightly convex whorls; suture linear. Surface ornamented with three conspicuous, spiral, acute ribs and spiral and transverse striae; the sulci on each side of the central rib are of equal breadth, but the anterior rib is separated from the suture by a distance less than that which separates one rib from the next, whilst the posterior rib is separated from its corresponding suture by a distance greater than the breadth of the medial sulci. Last whorl truncately angular at the periphery; base spirally ribbed and striated. Aperture quadrate; outer lip imperfect.

Length 45 mm., breadth 12 mm.

Locality. Table Cape, R. M. Johnston (one example).

This species is distinct from the few living species which are conspicuously three-ribbed, by shape, ornament, and the unsymmetrical position of the revolving keels."

PLATYCOLPUS Donald 1900.

In this subgenus are included *T. quadrata* Donald (genotype), *T. guillaumei* Iredale, *T. scitula* Donald, *T. circumligata* Verco, and *T. mediolevis* Verco. Iredale refers the last two to *Colpospira,* but this is surely wrong, the apex being quite different. He speaks of the genus as having a weak sinus, while his own and Verco's figures show a strong one. Finlay's specimens of *T. guillaumei* and *T. quadrata* show quite a valid notch.

The embryonic and subsequent development is entirely different from that of *Colpospira* with which this series appears to have no relation. On the other hand, *Platycolpus* seems to be closely allied to *Ctenocolpus,* the only features of difference mentioned by Iredale are the noduled keels and weak sinus of *Ctenocolpus.* Noduling of the spirals arises irregularly in many Turritellas.

GLYPTOZARIA Iredale 1924.

This genus with *T. opulenta* Hedley as genotype includes the fossil *T. transenna* Tenison-Woods which Tate ([12]) referred to *Mathilda* and *Glyptozaria columnaria* here described as new:

GLYPTOZARIA COLUMNARIA sp. nov.

Shell turreted, whorls 10, protoconch depressed, of 1½ globose whorls, adult whorls regularly convex, sculptured with 2 keels on each whorl, the body whorl showing an extra rib at the anterior, crossed by numerous less valid axial ribs, about 24 on the body whorl. Base smooth, aperture rounded, with 3 flutes corresponding with ribs; outer lip rounded, slightly effuse at the base of the columella, which is straight. Suture slightly canaliculate. Animal unknown.

Holotype. Length 4·5 mm., width 1·5 mm.; 100 fathoms. Cape Pillar. Reg. No. D 11438 S.A. Museum.

PAREORA Marwick 1931.

Pareora Marwick 1931, N.Z. Geol. Soc., Pal. Bull., xiii, p. 94.

Here, with genotype *Eglisia striolata* Hutton, we place *Mesalia stylacris* Tate, the polygyrate protoconch and aperture continuous with the concave columella being consistent with the genus.

LIST OF NEW NAMES INTRODUCED IN THIS PAPER:

Turritella terebra occidua subsp. nov.
Kimberia subgen. nov. for *Turritella kimberi* Verco.
Turritella murrayana subrudis subsp. nov.
Turritella latissima sp. nov.
Turritella acricula adelaidensis subsp. nov.
Turritella acricula victoriensis subsp. nov.
Turritella acricula tasmaniensis subsp. nov.
Turritella subacricula sp. nov.
Turritella trilix sp. nov.
Glyptozaria columnaria sp. nov.

NEW LOCALITIES FOR *TURRITELLA SPP.*

T. runcinata juvs. Hopetoun, W.A.
T. accisa. Hopetoun, 30 fathoms.

([12]) Trans. Roy. Soc., S. Aust., xvii, p. 335.

T. accisa, numerous. 81 fathoms, 80 m. W. of Eucla.
T. accisa, 50-120 fathoms. Great Australian Bight. W. of Eucla.
T. iredalei. Esperance, W.A.
T. smithiana, 300 fathoms, 120 m. W. of Eucla.

LIST OF AUSTRALIAN TURRITELLIDAE MENTIONED IN THIS PAPER:

TURRITELLA Lamarck 1799.

Mein. Soc. H. Nat. Paris, p. 74.
Genotype (by Monotypy) *Turbo terebra* Linn.

1. *Turbo terebra* Linn. 1758, Syst. Nat. ed. 10, p. 766.
2. *Turritella terebra occidua* Cotton and Woods, 1935.

Subgenus KIMBERIA Cotton and Woods.

Genotype (by original designation) *T. kimberi* Verco.

3. *Turritella kimberi* Verco 1908, Trans. Roy. Soc., S. Aust., xxxii, p. 342, pl. xv, fig. 14-15. 20 fath. Backstairs Passage, S.A.
4. *Turritella neptunensis* Verco 1910, *Ibid.* xxxiv, p. 120, pl. xxx, fig. 7. 104 fath. 35 miles S.W. of Neptune Is., S.A.
5. *Turritella microscopica* May, 1911, Proc. Roy. Soc., Tas., 1910, p. 395, pl. xv, fig. 23.

Subgenus MAORICOLPUS Finlay, 1926.

Trans. N.Z. Inst., lvii, p. 389. Genotype (by original designation) *T. rosea* Q. & G.

6. †*Torcula murrayana* Tate, 1885. Proc. Roy. Soc., Tas., 1884, p. 227, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 340, pl. viii, fig. 3. River Murray Cliffs, Lower Miocene.
7. †*Turritella murrayana subrudis* Cotton and Woods, 1935. Abattoirs Bore, Upper Pliocene.
8. †*Turritella latissima* Cotton and Woods, 1935. Table Cape, Lower Miocene.

Subgenus STIRACOLPUS Finlay, 1926.

Trans. N.Z. Inst., lvii, p. 389. Genotype (by original designation) *T. symmetrica* Hutton.

9. *Turritella godeffroyana* Donald, 1900, Proc. Mal. Soc., iv, No. 2, p. 53, pl. v, fig. 6, 6a. Bass Strait.
10. *Turritella smithiana* Donald, 1900, *Ibid.*, p. 52, pl. xv, fig. 1. Off Sydney, 410 fath.

11. *Turritella atkinsoni* Tate and May, 1900, Trans. Roy. Soc., S. Aust., xxiv, p. 95. New name for *T. tasmanica* T-Wds., 1876, Proc. Roy. Soc., Tas., 1875, p. 140, *non* Reeve 1849. Also Tate and May, 1901 (Dec.), Proc. Linn. Soc., N.S.W., xxvi, 3, p. 378, pl. xxiii, fig. 15-17. Long Bay, Tasmania. Synonym *T. tasmaniensis* (T.-Wds.), Tate and May, 1900 (Dec.), *loc. cit.*, quoted as equivalent name to *T. tasmanica.*
12. *Turritella medioangulata* Verco 1910, Trans. Roy. Soc., S. Aust., xxxiv, p. 125, pl. xxx, fig. 8, 9. 104 fath. 35 miles S.W. of Neptune Is., S.A. A closely allied species regarded by Verco as a variety of *T. atkinsoni.*

Subgenus GAZAMEDA Iredale, 1924.

Proc. Linn. Soc., N.S.W., xlix (iii), 1924, p. 247.

13. *Turritella gunnii* Reeve, 1849, Conch. Icon., v, pl. ix, fig. 45. Symon, *T. philippensis* Watson 1881, Journ. Linn. Soc., xv, p. 223, Chall. Rep. Zool., xv, p. 479, pl. xxx, fig. 6, 35 fath. Port Phillip.
14. †*Turritella septifraga* Tate 1893, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 336, pl. xviii, fig. 5. Spring Creek, Janjukian.
15. †*Turritella acricula acricula* Tate, 1893, *Ibid.* p. 339, pl. viii, fig. 4. River Murray Cliffs, Lower Miocene.
16. †*Turritella acricula adelaidensis* Cotton and Woods, 1935. Abattoirs Bore, Adelaide, Upper Pliocene.
17. †*Turritella acricula victoriensis* Cotton and Woods, 1935. *Turritella acricula* var. Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 340, pl. ix, fig. 4, 7.
18. †*Turritella acricula tasmaniensis* Cotton and Woods, 1935. *Turritella acricula* var. Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 340, pl. ix, fig. 12.
19. †*Turritella subacricula* Cotton and Woods, 1935.
20. *Turritella tasmanica* Reeve, 1849, Conch. Icon., v, pl. ix, fig. 42. Van Diemen's Land. Synon. *Turritella subsquamosa* Dunker, 1871, Mal. Blatt., xviii, p. 152. Bass Strait. *Turritella acuta* Tenison-Woods, 1876, Proc. Roy. Soc., Tas., 1876, p. 143. Long Bay, Tasmania. *Turritella lamellosa* Watson, 1881, Journ. Linn. Soc. Zool., xv, p. 229, Chall. Rep. Zool., xv, 1886, p. 474, pl. xxix, fig. 6. 40 fath., off East Moncoeur Is., Bass Strait. *Turritella oxyacris* Tate 1897, Trans. Roy. Soc., S. Aust., xxi, 1897, p. 41; new name for *T. acuta* T.-Wds., *non* Mayer, 1859.
21. *Gazameda iredalei* Finlay 1927, Trans. N.Z. Inst., lvii, p. 496. New name for *T. clathrata* Kiener, 1843, Icon. Coq. Viv., 38, pl. xiv, fig. 1, *non* Deshayes 1833 "Shores of New Holland" (S.A.).
22. † *Turritella multicincturalis* Chapman and Crespin, 1928, Rec. Geol. Surv., Vic., v, 1, p. 116, pl. viii, fig. 46. Sorrento Bore, 741 ft. (Kalimnan).

Subgenus CTENOCOLPUS Iredale, 1928.

Rec. Aust. Mus., xiv, 4, p. 266. Genotype (by original designation) *T. australis* Lamarck,

23. *Turritella australis* Lamarck, 1822, An. S. Vert., vii, p. 59; also Kiener 1843, Coq. Viv. 36, pl., fig. 3. Synon. *T. granulifer* T.-Wds., 1876, Proc. Roy. Soc., Tas., 1875, p. 142. Port Arthur, Tasmania.
24. †*Turritella pagodula* Tate, 1893, Trans. Roy. Soc., S. Aust., xvii, p. 336.
25. †*Turritella terebellata* Tate, 1893, Trans. Roy. Soc., S. Aust., xvii, p. 336. Limestone Creek, Glenelg River (Werrikooian). Noted as being like *T. pagodula* but with anterior keel nodulose; this, together with the locality, seems to validate the species.
26. *Turritella curialis* Hedley, 1907, Rec. Aust. Mus., vi, 5, p. 357, pl. lxvii, fig. 19. 800 fath. 35 miles east of Sydney.
27. *Turritella joannae* Hedley, 1923, Proc. Linn. Soc., N.S.W., xlvii, 3, p. 311. New name for *T.* (*Colpospira*) *crenulata* Donald, 1900, Proc. Mal. Soc., iv, 2, p. 52, pl. v, fig. 26, *non* Nyst. 1843. Synon. *Turritella reevi* Cossman, 1912, Ess. Pal. Comp. ix, p. 119, *non* Dautz and Fisher, 1907; new name for *T. crenulata* Donald.
28. †*Turritella medioplicatilis* Chapman & Crespin, 1928, Rec. Geol. Surv. Vict., v, 1, p. 116, pl. viii, fig. 47. 1,461 ft. Sorrento Bore (Balcombian).
29. †*Turritella warburtonii* Tenison-Woods, 1876, Proc. Roy. Soc., Tas., 1876, p. 99; Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 337, pl. viii, fig. 2 (topotype). Table Cape, Tasmania (Lower Miocene).
30. †*Turritella sturtii* Tenison-Woods, 1876, Proc. Roy. Soc., Tas., 1876, p. 99; Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 338, pl. viii, fig. 6 (topotype).

Subgenus COLPOSPIRA Donald, 1900.

Proc. Mal. Soc., iv, 2, p. 51. Genotype (by original designation) *T. runcinata* Watson.

31. *Turritella runcinata* Watson, 1881, Journ. Linn. Soc., Zool., xv, p. 218, Chall. Rep. Zool., xv, p. 475, pl. xxx, fig. 3. 38-40 fath. East Moncoeur Is., Bass Strait. *Torcula tennilirata* Dunker, 1869, Mus. Godeff., Cat. 4, p. 77, No. 3433; *Nomen nudum.* Bass Strait. *Murchisoni sutoris* Dunker, 1874, *ibid.* 5, p. 148, substitute name for *T. tennilirata* referred to *Zaria* on p. 212. Name validated as a synonym of *runcinata* by Donald 1900, Proc. Mal. Soc., iv, 2, p. 50. *Turritella higginsi* Petterd, 1884, Journ. Conch., iv, p. 135. Tamar Heads, Tasmania.

32. *Turritella accisi* Watson, 1881, Journ. Linn. Soc., Zool., xv, p. 220, *Ibid.* 1886, p. 476, pl. xxxi, fig. 4.
33. *Turritella sinuata* Reeve 1849, Conch. Icon., v, pl. ix, fig. 62. *Turritella incisa* Tenison-Woods, 1878, Proc. Linn. Soc., N.S.W., 4, p. 262, Iredale, 1925, Rec. Aust. Mus., xiv, 4, p. 267, pl. xliii, fig. 23. *Turritella sophiae* Brazier, 1883, Proc. Linn. Soc., N.S.W., viii, p. 227; new name for *T. incisa* T.-Wds., *non* Reeve, 1849.
34. *Turritella cordismei* Watson 1881, Journ. Linn. Soc., Zool., xv, p. 224, Chall. Rep., Zool., xv, 1886, p. 469, pl. xxix, fig. 1. 38-40 fath. East Mancoeur Is., Bass Strait.
35. †*Turritella platyspira* Tenison-Woods, 1879, Proc. Linn. Soc., N.S.W., iii, p. 234, pl. xx, fig. 13. Muddy Creek Lr. (Balcombian).
36. *Turritella acinella* Chapman and Crespin, 1928, Rec. Geol. Surv., Vic., v, 1, p. 115, pl. viii, fig. 45. 1,310 ft. Sorrento Bore (Balcombian).
37. †*Turritella aldingae* Tate 1882, Trans. Roy. Soc., S. Aust., v, 42; *ibid.* Dec., xvii, 1893, p. 336, pl. viii, fig. 1. Aldinga, S.A. (Janjukian).
38. †*Turritella conspicabilis* Tate, 1893, Trans, Roy. Soc., S. Aust., xvii, p. 339, pl. viii, fig. 7. Gippsland Lakes (Kalimnan).
39. †*Turritella tristira* Tate, 1884, Proc. Roy. Soc., Tas., 1884, p. 227, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 338, pl. viii, fig. 8. Table Cape, Tasmania (Lower Miocene).

Subgenus PLATYCOLPUS Donald, 1900.

Proc. Mal. Soc., iv, 2, p. 53. Genotype (by original designation) *T. (Colpospira) quadrata* Donald.

40. *Turritella (Colpospira) quadrata* Donald, 1900, Proc. Mal. Soc., iv, 2, p. 53, pl. v, fig. 8-8b. 45 fath. Bass Strait.
41. *Colpospira guillaumei* Iredale, 1924, Proc. Linn. Soc., N.S.W., xlix, 3, p. 248, pl. xxxvi, fig. 4, 15. 5-10 fath. Twofold Bay, N.S.W.
42. *Turritella circumligata* Verco, 1910, Trans. Roy. Soc., S. Aust., xxxiv, p. 123, pl. 30, fig. 3, 4. 110 fath. Beachport, S.A.
43. *Turritella mediolevis* Verco 1910, Trans. Roy. Soc., S. Aust., xxxiv, p. 121, pl. xxx, fig. 5-6. 62 fath. Cape Borda, S.A.
44. *Turritella quadrata* var. *scitula* Donald, 1900, Proc. Mal. Soc., iv, 2, p. 54, pl. v, fig. 9.

GLYPTOZARIA Iredale, 1924.

Proc. Linn. Soc., N.S.W., xlix, 3, p. 248. Genotype (by original designation) *T. opulenta* Hedley.

45. *Turritella opulenta* Hedley, 1907, Rec. Aust. Mus., vi, 4, p. 292, pl. lxv, fig. 9. 41-50 fath. Cape Three Points, N.S.W.
46. †*Turritella transenna* Tenison-Woods, 1879, Proc. Linn. Soc., N.S.W., iii, p. 234, pl. 20, fig. 8. Muddy Creek (Balcombian); Tate Trans. Roy. Soc., S. Aust., xvii, p. 335.
47. *Glyptozaria columnaria* Cotton and Woods, 1935.

Genus PAREORA Marwick, 1931.

N.Z. Geol. Soc. Pal. Bull., xiii, p. 94. Genotype (by original designation) *Eglisia striolata* Hutton.

48. †*Masalia stylacris* Tate, 1893, Trans. Roy. Soc., S. Aust., xvii, p. 341, pl. ix, fig. 3. Aldinga, S.A. (Janjukian).

† Fossil.

DESCRIPTIONS OF FOSSIL CHITONS FROM EUROPE IN THE ASHBY COLLECTION AT THE SOUTH AUSTRALIAN MUSEUM

By EDWIN ASHBY, F.L.S., AND BERNARD C. COTTON, Conchologist, S.A. Museum.

The writers are greatly indebted to Dr. Jaroslav Sulc, of Prague, Czechoslovakia, for the gift of this valuable collection, and as no descriptions in English have yet been published we offer an account of the material submitted. The specimens are from the Eocene and Miocene beds at the places named below. In drawing up the descriptions here presented, the material was examined under a Zeiss binocular with paired objectives a3, and oculars No. 4, giving a magnification of 65 diameters.

The numbers and letters following the habitat indicate the geographical horizons. Refer to Sulc (1).

Lepidopleurus decoratus Rss.

The sculpture of the median valves is beautifully preserved, the lateral area is much raised, and the growth grooves are almost as deep as in *L. cajetanus* Poli, a living European form. The pleural area is decorated with granulose, rather wavy, longitudinal ribs composed of flat-topped grains, bridged across to the next parallel rib, as is usual in the genus *Callistochiton*. The same bridging (or semi-network) sculpture is present in the lateral area.

Habitat: Rudoltice, 2.1.c. (Three fragments of median valves).

Lepidopleurus (Parachiton) thielei Sulc.

The type of sculpture much resembles that of the Australian *L. columnarius* Hedley & May, which was dredged by May off Cape Pillar, Tasmania. The posterior slope behind the mucro is very steep and concave, the longitudinal riblets are close together, and minutely granulose but without any bridging.

Habitat: Steinabrunn, 10.1. (One tail valve).

Hanleya multigranosa Rss.

Head valve: Well elevated, but the sculpture looks very juvenile, coarse granules only just beginning to show on the outer margin. *Median valve:* Decorated with squamose granulose sculpture common to the genus *Acanthochiton*.

(1) Sulc, Annelen des Naturhistorischen Museums in Wien, Bd. 47, 1934, p. 1-31, pl. 1-2.

Tail valve: Mucro antemedian, placed about the anterior third; sculpture like that of the median valves but less flat. *Articulamentum:* We cannot detect any insertion plate in the head valve. Viewed from the upper side, the tail valve seems to show an insertion plate and some short slits, but it is possible that this edge is tegmentum. In one of the median valves on one side, the insertion plate is well developed and practically complete, and there is no sign of a slit, not even an inside suture corresponding with a slit that has been eroded. In this respect it accords with *Afossochiton* Ashby. This is of importance because Dr. Sulc suggests that the unslit appearance of some fossil acanthoid forms is due to the absorption or erosion of that portion of the insertion plate. It is evident that this species cannot be referred to the genus *Hanleya,* since in that genus there is no insertion plate in the median valves.

Habitat: Rudoltice, 2.1.c. (One head valve, two median valves, and one tail valve).

MIDDENDORFFIA LEPIDA RSS.

Head valve: Anterior slope convex, sculpture closely minutely granulose, a small area at the apex smooth. *Median valve:* Arched and beaked, the side slope, in a large valve, straight almost to the girdle but slightly curved near the edge, the whole of the valve covered with minute decussate sculpture except close to the beak, which is smooth; lateral area unusually narrow and only a little raised; the granules in this area larger than in the pleural area; the sculpture of a smaller valve is flatter, but this may be due to extreme juvenility. *Tail valve:* Rather flat, mucro median, posterior separated from anterior by a raised diagonal rib, posterior slope slightly concave. *Articulamentum:* Head valve teeth sharp, smooth edged, with seven well defined slits (ischnoid in character), sutural laminae of end valves weak, and suture between broad. Tail valve. Nine slits, median valve slits 1/1, the sutural laminae are stronger and more produced forward than in the end valves. In the larger of the two median valves and the tail valve, the edges of the laminae adjoining the sutural sinus are straight, and set at an angle of 45° to the median longitudinal line.

Habitat: Rudoltice, 2.1.c. (One head, two median, and one tail valve).

CALLOCHITON ZIGZAG Sulc.

The two fragments of median valves and the fragment of head valve were examined. The minute decussate sculpture of the tegmentum, the propped teeth, and the spongy eaves of the insertion plate conclusively prove that this is a true *Callochiton.*

Habitat: Knínice, 4.1.c. (One head, two median, and one tail valve, fragments).

Acanthochiton faluniensis Roch.

Head valve: Elevated, showing in one valve indications of five rayfolds, the whole decorated with closely packed, evenly arranged, flat-topped grains. *Median valve:* Dorsal area narrow, raised and longitudinally grooved; the pleural and lateral areas are not differentiated, but equally decorated with flat grains similar to the head valve but larger, and arranged in longitudinal rows. *Tail valve:* Rather worn, mucro central, well defined, posterior slope slightly concave, a diagonal fold separates the anterior from the posterior, sculpture similar to the median valve. *Articulamentum:* Head valve insertion plate broad, slits five, median valve slits 1/1, tail valve two slits. This is a typical *Acanthochiton.*

Habitat: Kninice, 4.1.c. (Several of each valve).

Acanthochiton (?) faluniensis Roch.

Two fragments of median valves differ in two respects from the Kninice examples described above. Each specimen shows deeper longitudinal grooving on the dorsal area, but this difference may be due to the better preservation of this sculpture.

The second difference is only exhibited in one of the two specimens. In this the granulose sculpture is more widely spaced, and many of the grains are broadly ovate. With more material, especially if it included end valves, the species may be specifically separated from *Acanthochiton faluniensis* Roch.

Habitat: Steinabrunn, 10.1. (Two portions of median valves with sculpture well preserved).

Cryptoplax (?) weinlandi Sulc.

We selected seven valves, all median, five representing one species, and two another form or distinct species.

Form No. 1. Median valve: 3·5 mm. long, 2 mm. broad. A little worn, tegmentum complete, sutural laminae fairly well preserved. Dorsal area narrow and seemingly smooth, the rest of the tegmentum decorated with six well raised ribs (with narrow interstitial grooves), of which four run the full length of the valve; two shorter ribs near the girdle; posterior of valve bluntly beaked, no granulose sculpture visible, and as the preservation is good the sculpture cannot have been eroded.

Habitat: Kninice, 4.1.c.

Form No. 2. Median valve: One example is 1 mm. in width and 2·9 mm. in length. The other is fully as wide, but only 2 mm. in length (but this valve is not perfect). Both have narrow dorsal areas and longitudinal parallel ribbing,

the ribs narrow and shallow, the interstitial grooves very wide, and no granulose sculpture. The grooving or ribbing is the reverse of Form 1.

Habitat: Kninice, 4.1.c.

It is probable that two distinct species at least are represented by these forms. There is one striking difference between these juvenile examples from Europe and the species of the same genus now living in Australian waters. In the latter the very juvenile sculpture is granulose, and changes into longitudinal sculpture as maturity approaches, whereas in the fossils there is no granulose sculpture. Another important feature is that in the two fossil species *Cryptoplax halli* and *Cryptoplax gatliffi* described from Australia, no example has been seen showing tegmental sculpture, whereas in all seven examples from Kninice, tegmental sculpture is clearly seen. The entire absence of tegmental sculpture in the fossil Australian species casts some doubt on their identification as valves of a *Crytoplax*. The only feasible explanation is that some acid solution has dissolved away the tegmentum and left the articulamentum. Against this is the fact that in the same beds with the fossil *Cryptoplax* are found well preserved examples of other genera of chitons.

ISCHNOCHITON RUDOLTICENSIS Sule.

Head valve: The upper two-thirds is smooth, the outer third minutely decussate. *Tail valve:* The mucro is well defined, and raised slightly ante-median; the posterior slope immediately behind the mucro is very steep and then abruptly flat, the flat portion being much extended posteriorly, giving the effect of a strongly concave posterior slope. Sculpture irregularly minutely decussate, the granules fused together in places. A diagonal rib divides the posterior from the anterior in this valve. The anterior is similar to the posterior in sculpture except near the margin, where several granulose ribs appear. *Median valve:* The fragment represents only a little more than half the valve, but the sculpture is well preserved, it must have belonged to a specimen about three times as large as those from which the tail valves come. The sculpture is very coarse, and distinct from that on the two tail valves described above. This median valve is very flatly arched, not carinated, the posterior of the dorsal area is smooth, with ill defined decussation where it adjoins the pleural area. The lateral area is strongly raised, and crossed in the outer half by four very much raised vermiform ribs; the upper half of this area shows only shallow transverse ribbing. The sculpture of the pleural area consists of twelve strong, subgranulose, longitudinal ribs, the grooves between these ribs being only one-third the width of the ribs.

Articulamentum: Head valve nine slits, the inside is highly polished, and

showing parallel grooving. Median valve slits 1/1, sutural laminae laterally broad but anteriorly shallow. Tail valve twelve slits, sutural laminae imperfect.

Habitat: Rudoltice, 2.1.c. (One example of each valve).

The difference in the sculpture between the median valve and that of the end valves is so great that they appear to be different species, but being aware that the character of the sculpture in the very juvenile is often reversed in the adult, we may assume that such is the case in this species.

CHITON (CORALLINUS) DENUDATUS RSS.

Median valve: Carinated, side slope steep, dorsal area smooth; lateral area raised, seemingly unsculptured; pleural area crossed by seven narrow longitudinal grooves, the ribs between being flat, smooth, and much broader than the grooves, giving the appearance of weatherboarding or imbricating tiling. *Tail valve:* Mucro ante-median at the anterior third, is barely raised, but defined by the sculpture; elevated, the posterior slope convex and steep, unsculptured, the anterior portion sculptured similar to the pleural areas of the median valve; five longitudinal grooves. *Articulamentum:* Median valve slits 1/1, tail valve slits ten, rather irregular, inside pink, sutural laminae shallow, sinus broad. Although the serrated edge of teeth on the insertion plate is not clearly seen, it seems probable that this is correctly referred to the genus *Chiton s.s.*

Habitat: Rudoltice, 2.1.c. (One median and one tail valve).

CHITON BOHEMICUS ROCH.

Head valve: Elevated, slope fairly steep, very slightly convex, surface minutely decussate, and with evidence of shallow ray ribs. *Median valve:* Flat, longitudinally narrow, side slope shallow, almost straight; lateral area raised and smooth; pleural area with five longitudinal grooves, ridges between wide and flat, giving the appearance of imbricating. *Tail valve:* Very flat, mucro defined by a diagonal rib which divides the two areas, the anterior similar to the pleural of the median valves showing longitudinal grooves, dorsal area wide and smooth, carination shallow, posterior area smooth, posterior slope very shallow and flat. *Articulamentum:* Pale pink, head valve nine slits, irregular teeth slightly serrate; median valve slits 1/1, tail valve slits 11, irregular, slightly serrate.

Habitat: Rudoltice, 2.1.c. (One head, one tail, and one median valve).

CHITON JUTTNERI SULC.

Head valve: The entire surface pitted and wrinkled, the outer two-thirds showing thirteen broad, subgranulose ray ribs. *Median valves:* Fragments only, lateral area raised and divided equally by one deep, radiating groove, the ribs

showing transverse growth grooves, the pleural area crossed by seven longitudinal, much curved, deep, narrow grooves, the ribs between proportionately broad and flat; where these grooves turn sharply upwards at the junction with the lateral areas they form seven deep pits; dorsal area shallow, broad, and smooth. *Tail valve:* Mucro at the anterior third, defined by a shallow diagonal rib, anterior portion decorated as in the pleural area of the median valves (but in shape slightly convex), portion behind the mucro shallowly concave, smooth behind the mucro, outer third showing twenty short, shallow, granulose ray ribs. *Articulamentum:* White and pale pink, highly polished. Head valve slits six, median slits 1/1, tail valve seven slits, sutural laminae small, teeth serrate.

Habitat: Rudoltice, 2.1.c. (One tail, one head, and two median valves).

CALLOCHITON RARIPLICATUS RSS.

Sule identified this as *"Chiton" rariplicatus*, but we maintain that it should be placed in the genus *Callochiton*.

Median valve: Beaked, showing subcarination near the beak, otherwise arched, side slope straight except near the beak; lateral area very broad and smooth, very slightly raised; pleural area smooth except for five shallow, very narrow ribs, that commence at the lateral area, and with the exception of the outer one, traverse half way across the area; the third rib from the dorsal area has a short rib close to it, but not in contact. *Tail valve:* Mucro at the anterior fourth, defined but shallow, posterior slope apparently faintly convex, without sculpture other than slight decussation seen under 65 diameters magnification; the much reduced anterior portion, which is very small, shows three narrow, sharply raised ribs. *Articulamentum:* The half median valve has two very well defined slits, the slits long and deep, the insertion plate broad and turned downwards in a peculiar manner; the sutural laminae shallow, but laterally very broad, and joined across the middle line. *Tail valve:* Slits nine, teeth show some grooves, eaves spongy.

Habitat: Rudoltice, 2.1.c. (One tail, and half a median valve).

The double slitting on the one side of the half median valve, the joining of the sutural laminae across the middle line, combined with the smooth sculpture and apparent propping of the teeth and the spongy eaves, show this to be a *Callochiton* and not a *Chiton s.s.* The bending downwards of the insertion plate is the only feature that is difficult to explain.

MAT. MUS. MELB.

NATIONAL MUSEUM
25 MAR 1937
OF VICTORIA

THREE NEW CUMACEA FROM SOUTH AUSTRALIA

By HERBERT M. HALE, Director, South Australian Museum.

Fig. 1–6.

Two of the species described below were collected by Mr. B. C. Cotton from stones dredged in shallow water. The third was taken by Mr. W. H. Baker a long time ago.

Family BODOTRIIDAE

Cyclaspis G. O. Sars.

Cyclaspis caprella sp. nov.

Adult male. Integument not highly indurated. Carapace more than one-fourth total length, and with greatest width only about one-half its length and equal to its height; dorsum with a rather feeble median longitudinal ridge, and

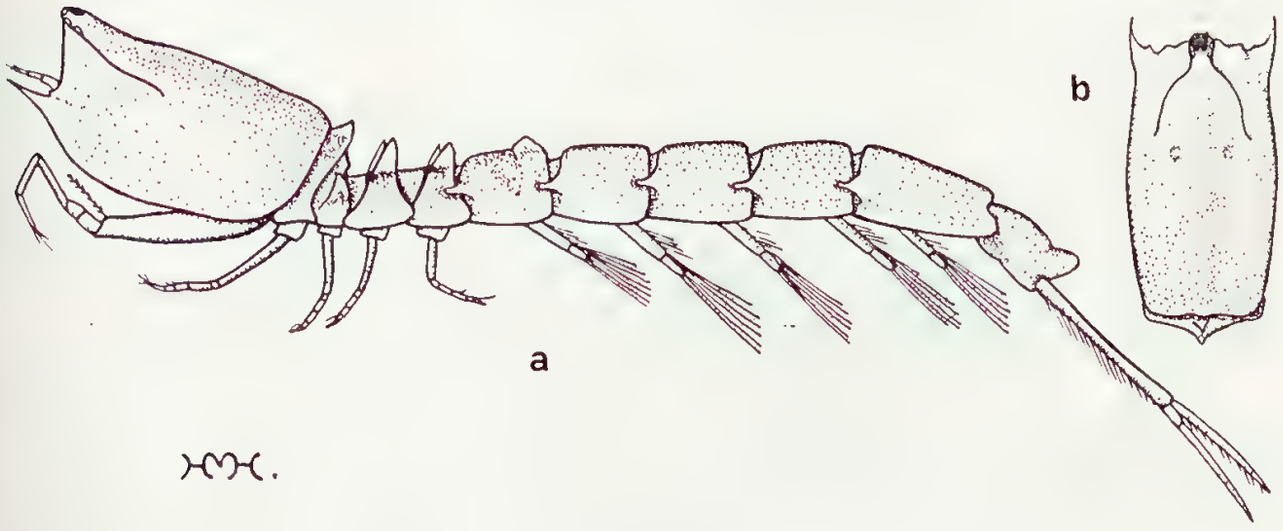

Fig. 1. *Cyclaspis caprella,* type male; a, lateral view; b, dorsal view of carapace (× 19).

with a pair of shallow and inconspicuous depressions in front of the middle of length; antennal notch distinct, and antennal angle subacute; inferior margin on each side produced forwards anteriorly to form an acute inwardly curved horn, which reaches a little beyond the level of the ocular lobe. Pseudorostral lobes not quite reaching apex of the prominent ocular lobe, which bears a number of lenses, and is pigmented.

First pedigerous somite concealed. Second with an elevated compressed dorsal tubercle. Third not so deep, with an indistinct elevation on each lateral face. Fourth and fifth with pleural portions expanded, each with a pair of triangular dorsal tubercles.

All pleon somites with a faint median dorsal ridge; on the first somite the dorsal ridge is elevated posteriorly as a blunt tubercle, and there is an obscure elevation on each side; first five somites with strong articular processes.

Outer flagellum of first antennae two-jointed. Lash of second antennae reaching to end of peduncle of uropods, concealed beneath overhanging inferolateral margins of pleon.

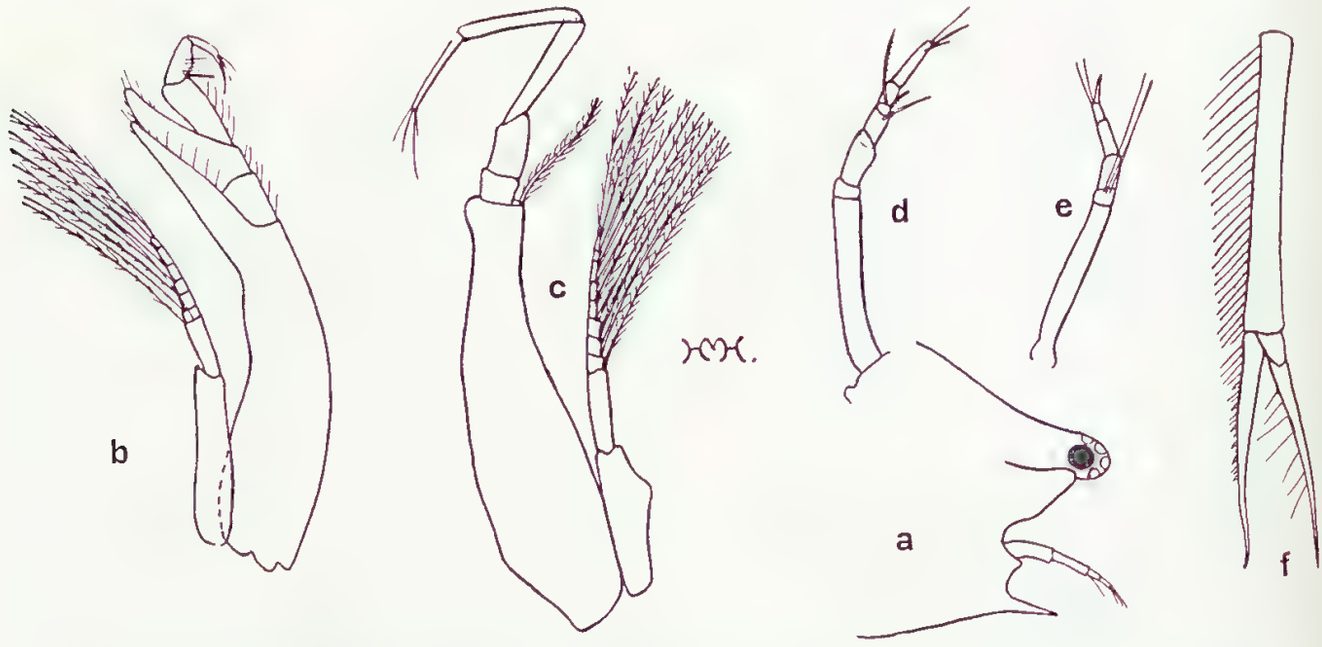

Fig. 2. *Cyclaspis caprella,* type male; a, lateral view of front of carapace; b, third maxilliped; c, d, and e, first, second, and third peraeopods (all × 45); f, uropod (× 32).

Basis of third maxillipeds scarcely bent, and with apical process reaching nearly to level of apex of carpus; remaining joints together much shorter than basis; merus with very long external process extending beyond apex of carpus, which is rather elongate. Basis of first peraeopods equal in length to the remaining segments together, with a plumose seta at apex which is not at all produced; carpus and propodus equal in length, dactylus a little shorter. Second peraeopods longer than third to fifth pairs, with basis almost as long as the five terminal joints together, and with ischium distinct.

Peduncle of uropoda one-fourth as long again as endopod and three-fourths as long again as telsonic somite, with a row of rather long setae, which diminish in length posteriorly, on the inner margin; rami subequal in length, the exopod

slightly longer than the single-jointed endopod, and with widely-spaced setae on inner margin; endopod with setae and a few very short spines on inner margin.

Length 5·3 mm.

Colour pale brown.

Loc. South Australia: Off Black Point, Yorke Peninsula, 4-6 fath. bottom dredge (B. C. Cotton, Apl., 1934). Type, male, in South Australian Museum, Reg. No. C. 2044.

In this distinct species the carapace has procurved lateral cornua as in *Eocuma*, but differs in having the basis of the first peraeopods not produced distally into a pointed lobe, the second legs relatively long, with the ischium not suppressed, and the uropods typically as in *Cyclaspis* with elongate peduncle.

The strongly sculptured *C. bovis* Hale (1928, p. 32, fig. 1-2) has a pair of deep and massive lateral projections on the carapace, but has all the facies of *Cyclaspis*.

SYMPODOMMA Stebbing.

Three species of the genus may now be listed for Australian waters. The first of these was referred to *S. africanum* Stebbing by the writer (Hale, 1928, p. 40, fig. 9-10), the second was recently described from Queensland (Foxon, 1932, p. 388, fig. 5-6), and the third is recorded below. The Australian forms are easily separated.

a. Dorsal carina of carapace with three prominent teeth .. .. *africanum*
aa. Dorsal carina of carapace with no prominent teeth.
  b. Dorsal carina of carapace with one dorsal tooth. First joint of endopod of uropoda much longer than second. Dactylus of second peraeopod slender, longer than merus and carpus together .. .. *australiensis*
  bb. Dorsal carina of carapace with a row of more than a dozen small spines. First joint of endopod of uropoda subequal in length to second. Dactylus of second peraeopod stout, only about as long as carpus .. .. *bakeri*

SYMPODOMMA BAKERI sp. nov.

Non-ovigerous female. Integument moderately hard. Carapace twice as long as deep, very narrow, its greatest breadth considerably less than the depth; a little shorter than the five pedigerous somites together, and less than one-fourth the total length; dorsal carina sharp, with a series of fourteen small spines, the first situated at one-fourth of the length from the end of the ocular lobe, the last at the middle of the length. Ocular lobe narrow, subtriangular, extending beyond pseudorostral lobes, and with anterior margin crenulate; darkly pigmented, and

with several lenses. Pseudorostral lobes very narrowly subtruncate in dorsal view, with anterior edges crenulate. Antennal notch very narrow but rather deep, and antennal angle rounded and crenulate.

First pedigerous somite widened dorsally and inferiorly, its short lateral areas overlapped by the second somite; pleural parts of third to fifth somites backwardly produced.

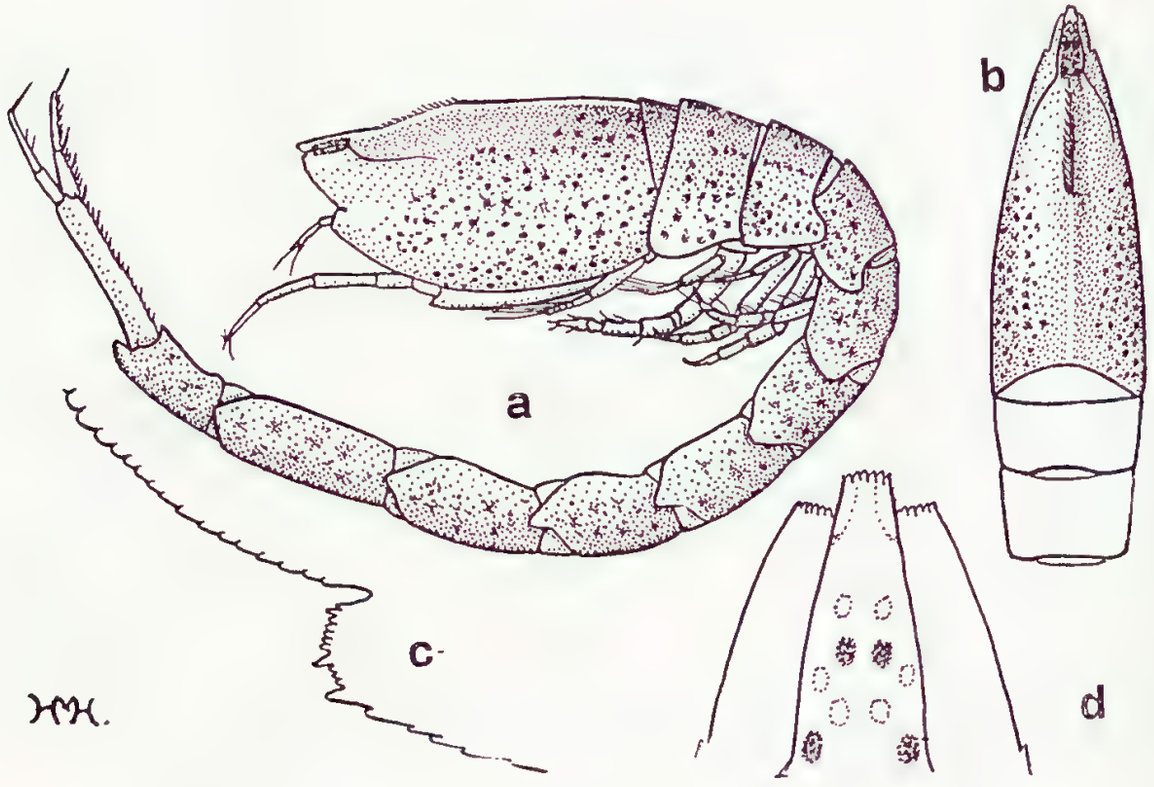

Fig. 3. *Sympodomma bakeri*, type female; a, lateral view; b, dorsal view of carapace (× 15); c, antennal notch and antero-lateral angle of carapace; d, dorsal view of anterior end of carapace (× 71).

Pleon somites smooth; first to fifth successively increasing in length, with postero-lateral margins backwardly produced; telsonic somite only as long as first, produced between bases of uropoda.

First antennae with first joint of peduncle stout, widened basally, nearly twice as long as the second, and much longer than the third; flagellum two-jointed, and terminating in a pair of jointed setae; accessory flagellum short but two-jointed.

Basis of third maxillipeds gently curved, much more than twice as long as the palp, and with produced distal portion reaching beyond distal margin of merus; ischium, merus, carpus, and propodus subequal in length, dactylus (exclusive of long terminal spine) a little shorter. First peraeopods extending well beyond anterior margin of carapace; basis slender, slightly curved towards its

base, and shorter than the remaining joints together; merus with a short stout apical spine; carpus and propodus subequal in length, dactylus a little shorter. Second peraeopods stout and armed with spines; ischium distinct, carpus slightly longer than merus and a little shorter than dactylus; propodus short, barely half as long as merus. Basis of third pair somewhat shorter than rest of limb, that of fourth one-half as long as remaining joints (including claw of dactylus), and that of third less than half as long as rest of limb; carpus of last three peraeopods longer than merus and propodus; dactylus short.

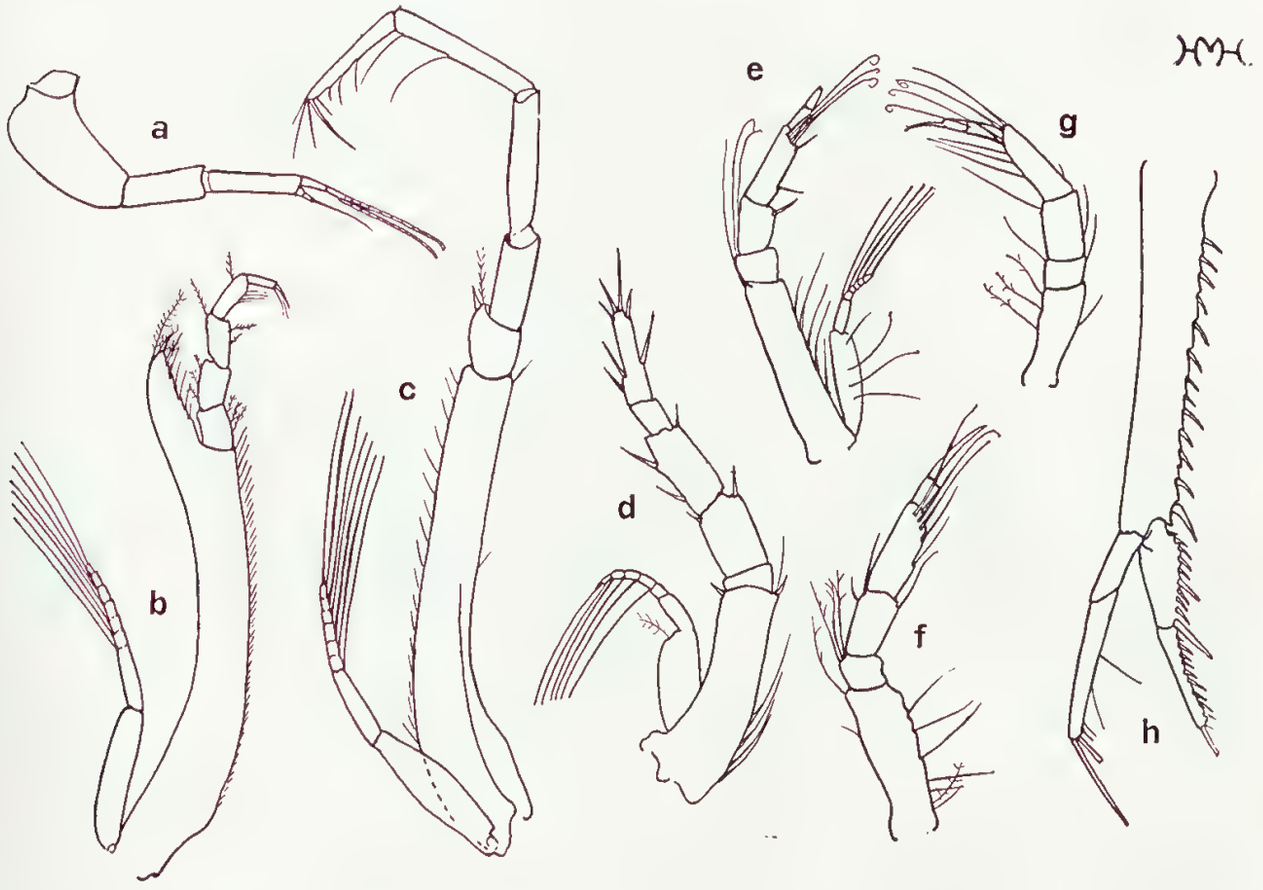

Fig. 4. *Sympodomma bakeri*, type female; a, first antenna (× 40); b, third maxilliped; c to g, first to fifth peraeopods; h, uropods (× 25).

Peduncle of uropods nearly as long as fifth pleon somite, and one-and-three-fourths times as long as the rami, which are equal in length; inner margin armed with more than a dozen spines; exopod with first joint rather more than half as long as second, its apex with several long spines, but inner margin with a few setae only; endopod with the two joints subequal in length, the inner margins of each armed with about ten spines of different lengths, and apex with slender spines.

Colour brown, marked with dark brown stellate spots.

Length 10 mm.

Loc. South Australia: Gulf St. Vincent (W. H. Baker, 1910). Type in South Australian Museum, Reg. No. C. 2043.

This species is named after my esteemed friend Mr. W. H. Baker, who has done so much for carcinology in our State. It has all the facies typical of *Sympodomma,* the narrow ocular lobe, the anteriorly produced basis of the third maxillipeds, etc.

The only other species of the genus which lacks prominent dorsal teeth on the carapace is *S. weberi* (Calman, 1905, p. 6, pl. i, fig. 7-12), but that species differs in having the carapace of different shape, with no distinct row of spines on the dorsal carina, the dactylus of the first peraeopods much longer than the carpus, the first joint of the endopod of the uropoda much longer than the second, etc.

FAMILY DIASTYLIDAE

DIMORPHOSTYLIS Zimmer.

DIMORPHOSTYLIS COTTONI sp. nov.

Male. Integument flexible and strong. Carapace with well-marked and finely crenulate lateral ridges; five of these are long and forwardly directed, the most posterior submarginal to the hinder edge, and the four following not meeting in the mid-line; a short ridge extends across the base of each pseudorostral lobe and meets the anterior rounded portion of the broad eyelobe, while a short ridge joins the eyelobe at the middle of its length, and connects it with an oblique backwardly-directed ridge which touches the pseudorostral ridge on each side. Carapace a little less than one-third total length, and almost twice as long as the five pedigerous somites together; vertical height about one-half length, and considerably less than greatest width. Pseudorostral lobes short, scarcely upturned, apically subacute. Antennal notch distinct and antennal angle rounded. Ocular lobe with a single large lens, which is not pigmented.

Second to fourth pedigerous somites subequal in length, and fifth a little longer; first largely concealed; second to fourth side plates expanded, on the third pedigerous somite overlapping that of second and fourth.

First three somites of pleon subequal in length; fourth longer and subequal in length to sixth; fifth nearly half as long again as sixth. Telson, including its apical spines, about as long as sixth somite; with a pair of upturned apical spines and three spines on each lateral margin of posterior portion. Second antennae with the flagellum reaching back to end of peduncle of uropoda.

Third maxilliped with basis geniculate, with a row of plumose spines on distal half of the outer edge and with apex produced and expanded on inner side, the

lamellate portion capped with several long plumose setae; palp less than one-half as long as basis; ischium and merus short, together not much longer than carpus, which is subequal in length to propodus; merus with a strong plumose seta on inner margin. Exopods of peraeopods expanded. First peraeopod extending for half its length beyond level of pseudorostrum; basis geniculate not produced apically, with plumose setae on outer edge and apex; ischium shorter than merus, which is half as long as carpus; propodus almost half as long again as carpus.

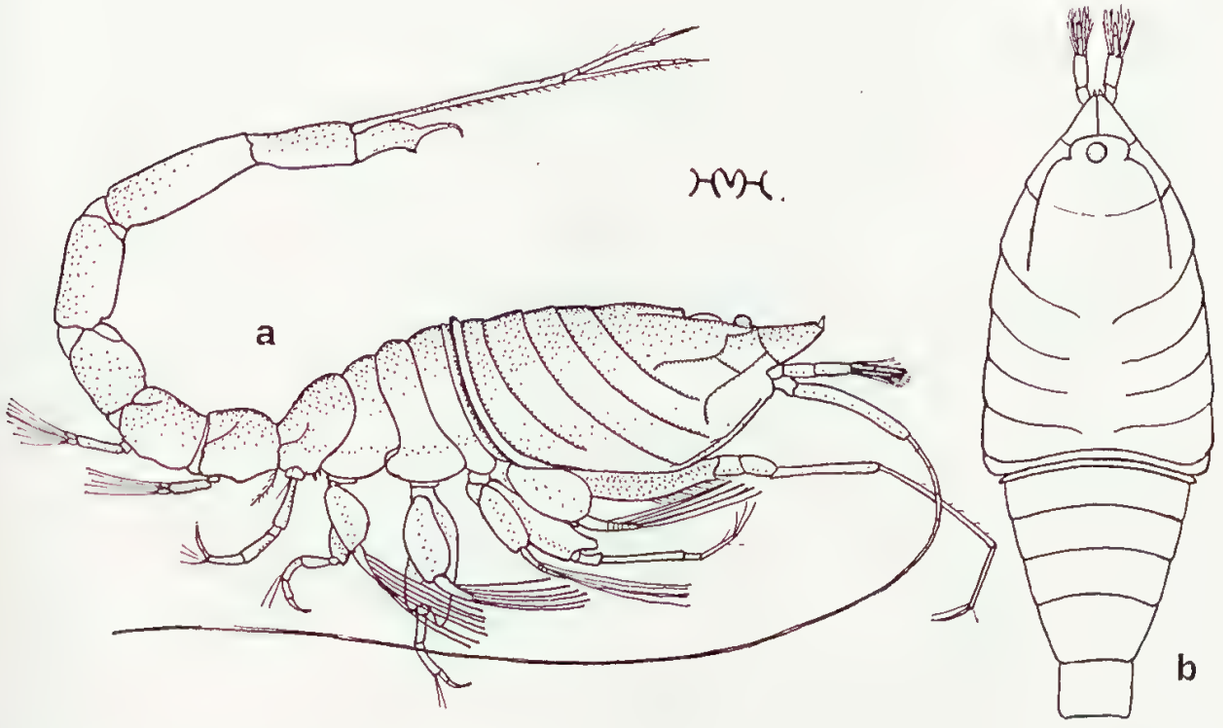

Fig. 5. *Dimorphostylis cottoni*, type male; a, lateral view; b, dorsal view of cephalothorax (× 26).

Second peraeopod reaching forward a little beyond basis of first pair, the basis widened at proximal third (where it is more than one-third the length) and with the apical expansion reaching to level of end of merus; ischium very short, and merus one-fourth as long as the elongate carpus. Third peraeopod with basis similar to that of second, but shorter, and with apical lamella smaller, reaching beyond distal margin of the ischium; merus and carpus subequal in length. Basis of fourth peraeopod with distal expansion shorter than in others; rest of limb much as in third. Fifth peraeopod with basis abruptly narrower, widest at apex; ischium about one-third as long as merus, which is equal in length to carpus.

Peduncle of uropoda twice as long as sixth pleon somite, with thirteen short plumose spines on inner edge; rami, including terminal spines, equal in length; without the spines the endopod is one-third as long again as exopod; first joint of

endopod two and a half times as long as second and third joints together, and with eleven marginal spines; third longer than second, and slightly shorter than terminal spine; second and third segments each with one spine at inner apical angle; basal joint of exopod one-fourth of the length of second, which is one-fourth as long again as terminal spine.

Colour white.

Length 5 mm.

Loc. South Australia: Gulf St. Vincent, 3 miles off Semaphore, bottom dredge, 5-7 fath. (B. C. Cotton, Nov., 1931). Type in South Australian Museum, Reg. No. C. 2042.

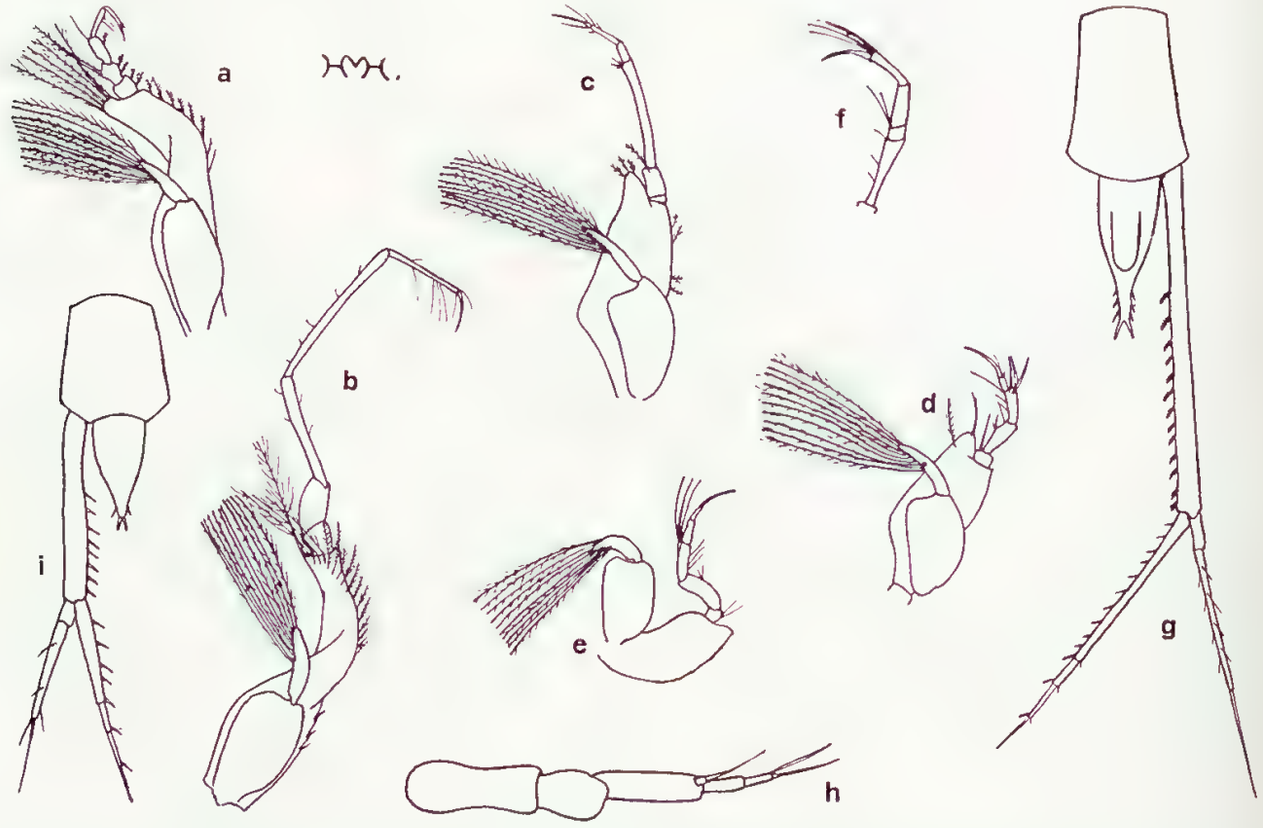

Fig. 6. *Dimorphostylis cottoni*, type male; a, third maxilliped; b to f, first to fifth peraeopods (× 29); g, terminal somites of pleon and uropod (× 43). Paratype immature male; h, first antenna (× 77); i, terminal somites of pleon and uropod (× 43).

A male 3·3 mm. in length was taken at the same time. In this the absence of pleopods and the state of development of the exopods of the legs indicate immaturity; the first antennae are not hairy, and have the second joints of the peduncle only about half as long as the first, which is longer than the third; the accessory flagellum is small and two-jointed, the outer three-jointed, the last segment minute. The telson has a pair of apical spines, but only one spine on each lateral margin near the apex. The uropods are relatively shorter than in the adult, the peduncle

being only one and one-half times as long as the sixth pleon somite, and barely longer than the endopod, instead of nearly half as long again; the proportions of the joints of the endopod are different, being 38 : 11 : 12, and the terminal spine 13. The peduncle of the uropods is armed with only eight marginal spines, the first segment of the endopod with five, and the second and third segments with one each.

The male of *D. cottoni* resembles the male of the genotype, from Japan, much more closely than does the Queensland *D. australis* Foxon (1932, p. 390, fig. 7-8). The antennae, uropoda, and general facies are quite similar, but in the South Australian form there is an additional, oblique, lateral ridge on the carapace, only one ocular lens instead of three, and no lateral flaps on the telson which has only two apical spines; further, the fifth pleon somite is apparently less elongate in *D. asiatica* (Zimmer 1921, p. 144, fig. 47-55).

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Calman, W. T. (1905) : *Siboga Exped.,* Mon. xxxvi.
Hale, Herbert M. (1928) : *Trans. Roy. Soc., S. Aust.,* lii.
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CUMACEA FROM A SOUTH AUSTRALIAN REEF

By HERBERT M. HALE, Director, South Australian Museum.

Fig. 1-23.

On the eastern side of Gulf St. Vincent and south of Adelaide is a series of flat reefs formed of Miocene limestone; they are largely exposed at low tide and, towards the outer edge, covered by at least a fathom of water at high tide.

The following notes concern a reef half a mile in length and situated at Sellick's Beach, 30 miles south of Adelaide.

Parts of the outer areas of this reef are covered with flat, loose stones, detritus from the hard Cambrian and Precambrian rocks and the Miocene bed-rock. The latter in particular are clothed on the upper faces with a short filamentous alga, and this, aided by the natural roughness of the soft stone, loosely holds a film of sand several millimetres in thickness, and much more where it fills cracks and crevices. Investigation showed that the sand lodged on these stones provides a footing for a surprising number of burrowing Crustacea, including Cumacea.

These littoral sand-dwellers were collected by lifting stones off the bottom, carefully bringing them to the surface so that the sand film was disturbed as little as possible, and immersing them in a large bucket of about 1% formalin (commercial formalin 1 part, sea water 40 parts); after a period the rocks were well rinsed in the solution and removed. The resultant debris was then poured into a strainer of 2 mm. mesh to separate the coarsest material, which was bottled in alcohol separately; finally the smaller detritus was washed in a cloth sieve, which removed most of the sand but retained the small crustaceans, etc.

It was found necessary to leave the stones in the formalin for a period of at least fifteen minutes; Amphipoda, in particular, leave their retreats at once, but some other forms are more resistant. Immediate "grading" of the debris was found to be advantageous, as the more delicate Crustacea thus survive damage.

Sandy patches on the reef, and the adjacent beach between tide marks, were also investigated. As regards Cumacea, collecting over a few square yards of the reef by the methods outlined above produced the following results:

(1) At least fifteen species, belonging to eleven genera, live in the shifting coating of sand on the stones of the reef. Two of these also occur in sandy patches on the reef and in the adjacent beach, where a form (*Gephyrocuma pala* gen. et. sp. nov.), not so far taken on stones, is found as well.

(2) All but four of the species from the reef have not been recorded from Australia previously.

(3) Although no tow-netting was carried out, males are represented in all but three of the species taken, and in only one of these three were more than two specimens secured.

Our knowledge of Australian Cumacea is regrettably fragmentary. Including the forms described in this paper, forty-six species are definitely named and recorded. Of these, twenty-five are now known to occur in South Australia (Hale, 1928, pp. 31-47, 1929, 1932, and 1936); only one has been taken in Victoria (Sars, 1887, p. 12); fourteen were found off Western Australia (Zimmer, 1914—two unidentified species also mentioned—and 1921; Hale, 1927, p. 47), and eight have been listed from Queensland waters (Sars, 1887, pp. 19 and 20; Foxon, 1932—who mentions that apparently three other species are also represented in the material which he examined). During a recent brief visit to Tasmania Mr. N. B. Tindale, at the writer's request, was good enough to pass some sand-filmed stones from a reef through weak formalin as described above, and four species were found amongst the debris so secured (pp. 417, 418, 424 and 437).

FAMILY BODOTRIIDAE.

CYCLASPIS G. O. Sars.

CYCLASPIS PURA sp. nov.

Ovigerous female. Integument firm, but delicate and easily broken; finely reticulate and sparsely pitted. Carapace with dorsal edge slightly arched, slightly less than one-third total length of animal, its depth more than half its length, and equal to the greatest breadth. Pseudorostral lobes barely reaching apex of the ocular lobe. Ocular lenses black. Antennal notch moderate and tooth subacute, rounded. Sides of carapace devoid of ridges or sculpture, but dorsum with a distinct median carina.

Greater part of first pedigerous somite concealed and second large, with a dorsal carina. Third and fourth somites slightly elevated dorsally, and dorsal margins in lateral view slightly concave: dorsum of third with postero-lateral angles tumid.

First five pleon somites with well-developed lateral articular processes and with barely discernible infero-lateral carinae, but no other sculpture; first to fourth and telsonic somites all of approximately equal length.

First antennae with second and third segments of peduncle subequal in length, and together shorter than the stout basal segment; inner flagellum represented by

a minute vestige and the outer three-jointed, the first segment twice as long as the other two together. Mandibles with ten to twelve spines on inner edge.

Basis of second maxillipeds nearly one-third as long again as remaining segments together, and with a long, plumose, apical seta on inner edge. Basis of third

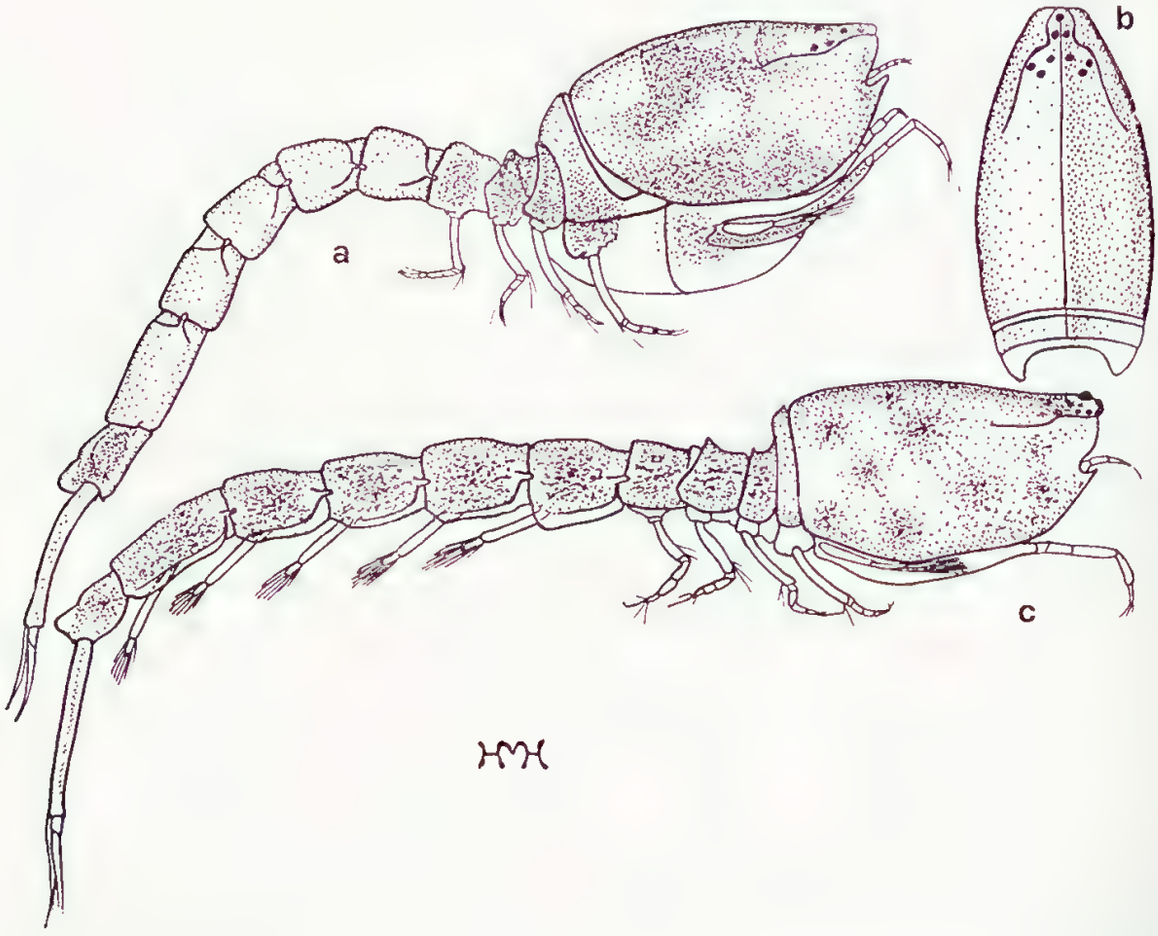

Fig. 1. *Cyclaspis pura*, type female; a, lateral view; b, dorsal view of carapace. c, Lateral view of allotype male (all × 23).

maxillipeds twice as long as rest of limb, bent outwards at middle of length, and with outer apical portion widened and extending forwards to level of insertion of carpus; ischium subcylindrical, and outer part of merus greatly produced, extending to external apical angle of the carpus. First peraeopod about as long as carapace, with carpus reaching slightly beyond level of antennal angle; basis distinctly longer than other segments together, narrowed distally and with inner apical angle somewhat produced, but not reaching apex of ischium; carpus as long as ischium and merus together, and longer than either propodus or dactylus, which are subequal in length. Basis of second legs not quite as long as remaining segments

together; ischium short, merus longer than carpus, which is longer than propodus; dactylus as long as merus.

Peduncle of uropods slender, nearly twice as long as telsonic somite, and one-fourth as long again as fifth pleon somite; exopod a little longer than endopod, and less than two-thirds as long as peduncle; endopod with two spines on inner margin.

Colour white, with dark brown mottlings and stellate markings.

Length 4·7 mm.

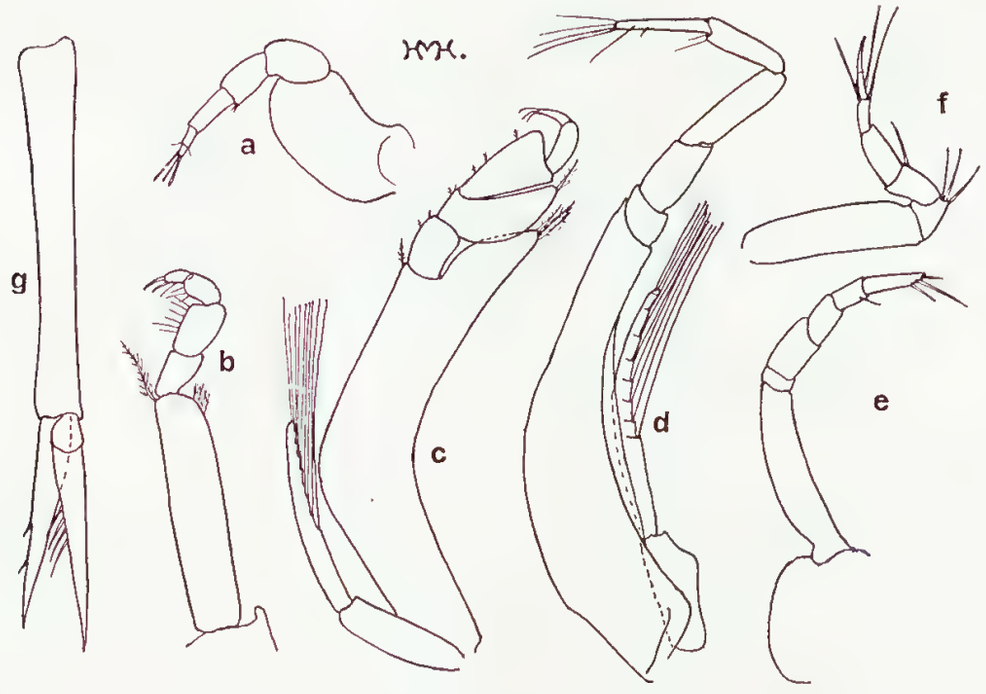

Fig. 2. *Cyclaspis pura,* ovigerous female; a, first antenna (× 110); b and c, second and third maxillipeds (× 70); d, e, and f, first, second, and fourth peracopods (× 70); g, uropod (× 60).

Adult male. Differs from the female in having the carapace relatively a little shorter, the ocular lenses larger, and the antennal notch somewhat wider, the first pedigerous somite wholly concealed, the second pedigerous somite shorter, and the uropods proportionately longer. The pleural parts of the third to fifth pedigerous somites are more expanded. The infero-lateral carinae of the pleon are much more distinct, overhanging the flagellum of the second antenna, which reaches back to beyond the middle of length of peduncle of uropod.

Length 4·7 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Beach, burrowing in sand at edge of sea (H. M. Hale, Mar., 1936), and Sellick's Reef, on stones, 1 fath. (H. M. Hale, Mar. and Apl., 1936); Yorke Peninsula, Cable Bay, on stones (H. Womersley, Apl., 1936). Types in South Australian Museum, Reg. No. C. 1995-1996.

In immature specimens the uropods are relatively shorter. Thus, in an ex-

ample 3·2 mm. in length the peduncle is only as long as the fifth pleon somite, and the exopod is nearly as long as the peduncle, while in a specimen 2·3 mm. in length the exopod slightly exceeds the peduncle in length.

This species was burrowing in white sand with which tiny fragments of dead leaves of *Cymodocea*, dark brown in colour, were sparsely admixed. The colouration of the animals closely simulated their surroundings, all being milk-white and varyingly marked with dark brown. A few examples have the colour pattern marked out by widely-spaced dots.

C. pura belongs to the group of species in which the pseudorostral lobes do not meet in front of the eyelobe, and in which the carapace is not sculptured—excepting for the dorsal carina which is often present. It resembles *C. levis* Thomson which has been recorded from Queensland by Foxon (1932, p. 390), but the basis of the first leg lacks a long apical seta, the uropods of the adult are much longer, there are no dorsal and lateral keels on the pleon, and there is no trace of a feeble keel running back from the antennal notch. In *C. pusilla* Sars (1887, p. 19, pl. i, fig. 21-23) the carapace is "almost globular", with the dorsum more arched; there is a slight median dorsal keel on the pleon somites, and the uropods are relatively shorter in the adult.

Cyclaspis formosae Zimmer (1921a, p. 124, fig. 15-18) is also rather like *C. pura*, but the carapace of that species apparently lacks a dorsal carina, the basis of the first peraeopods is shorter than the rest of the limb, and has an apical spine reaching to the end of the ischium, while the basis of the second peraeopods is a little longer than the remainder of the leg; further the uropoda are of different proportions, although it may be noted that Zimmer's specimens are immature.

LEPTOCUMA G. O. Sars.

An undescribed species from Sellick's Reef is apparently referable to *Leptocuma*.

Apart from the genotype, *L. kinbergii* Sars (1873, p. 24, pl. vi, fig. 29-33), two other species, *L minor* Calman (1912, p. 616, fig. 14-20) and *L. pulleinei* Hale (1928, p. 38, fig. 7-8), have been referred to the genus, while a fifth *Vaunthompsonia* (?) *australiae* Zimmer (1921, p. 4, fig. 1-7), is linked to this little assemblage of species by certain of its characters.

Leptocuma kinbergii is known only from the female, *L. minor* from the adult male and female, *L. pulleinei* from the immature male and ovigerous female, *L. sheardi* sp. nov. from the female, and *Vaunthompsonia* (?) *australiae* from a juvenile male. In view of the insufficiency of our knowledge regarding these five species, and in order to avoid subsequent confusion, it seems desirable temporarily to refer them all to *Leptocuma*. They may be separated thus:

a. Eye not pigmented. Pseudorostral lobes not or scarcely produced in front of ocular lobe. Uropoda with exopod shorter than endopod .. .. *kinbergii*

aa. Eye pigmented. Pseudorostral lobes a little produced in front of ocular lobe. Uropoda with exopod as long as or longer than endopod.

b. Proximal segment of endopod of uropoda shorter than second *pulleinei*

bb. Proximal segment of endopod of uropoda much longer than second.

c. Carpus of second peraeopods barely more than half as long as merus. Proximal joint of endopod of uropoda four to five times as long as second .. .. *australiae*

cc. Carpus of second peraeopods longer than merus. Proximal joint of endopod of uropoda twice as long as second.

d. Carapace without median dorsal carina. First peraeopods with basis a little longer than rest of limb, and with a tuft of long hairs on propodus. Carpus of second peraeopods not much longer than merus (as long as ischium and merus together) .. .. *minor*

dd. Carapace with a median dorsal carina. First peraeopods with basis shorter than rest of limb, and without tuft of long hairs on propodus. Carpus of second peraeopods more than one and one-half times as long as merus (distinctly longer than ischium and merus together) .. .. .. *sheardi*

L. sheardi is the only one of the above species lacking a subapical tuft of hairs on the propodus of the first peraeopods. *L. australiae* alone has a large spoon-shaped apical process on the basis of the first legs, and, according to Zimmer, also has very unusual third maxillipeds. These two forms differ from the others in having the five terminal joints of the first peraeopods together longer than the basis.

The carapace has a median dorsal carina in *L. pulleinei*, *L. australiae*, and *L. sheardi*.

The male of *L. australiae* and *L. pulleinei* possesses five pairs of pleopods, but in *L. minor* only three pairs are present in that sex.

Exopods are well developed on the first four pairs of peraeopods of the adult male of *L. minor*, but in the immature male of both *L. australiae* and *L. sheardi* that of the fourth leg is rudimentary. Zimmer suggests that this incomplete development of the last exopod may be a character of the juvenile male.

LEPTOCUMA SHEARDI sp. nov.

Female. Body slender, a little compressed. Carapace nearly one-fourth of total length, its vertical height equal to two-thirds its length; the lateral areas are marked with radiating striae, and the dorsum has a median longitudinal ridge. Pseudorostral lobes short and rounded, produced (but not in contact) in front of

ocular lobe for a distance equal to one-half of length of last-named. Ocular lobe wide and pigmented. Antennal notch very wide and shallow, and antennal angle rounded.

First pedigerous somite concealed excepting for a small dorsal section; second with pleural parts overlapping first somite and carapace; third overlapping second and fourth somites infero-laterally; pleural portions of fourth and fifth somites a little produced backwards.

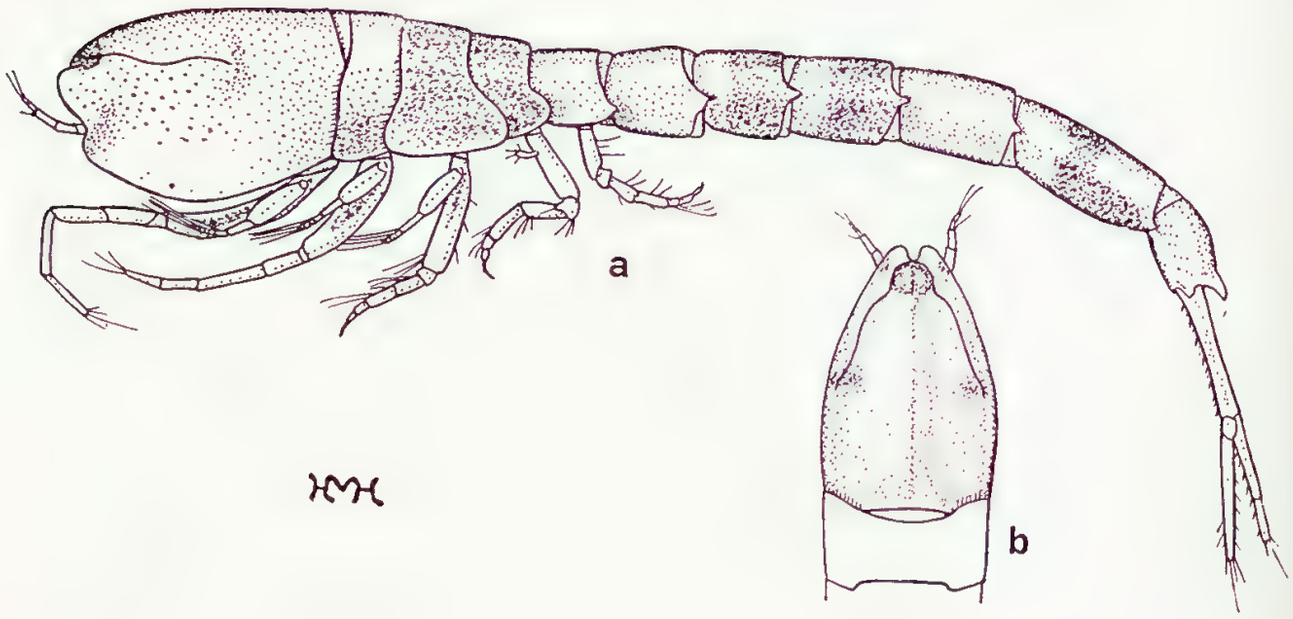

Fig. 3. *Leptocuma sheardi*, type female; a, lateral view; b, dorsal view of carapace (× 20).

First to fifth pleon somites successively increasing in size, the fifth being twice as long as the first; telsonic somite two-thirds as long as preceding somite.

First antennae with the two terminal joints of peduncle subequal in length, with the flagellum two-jointed and the accessory flagellum single-jointed.

Third maxillipeds with palp three-fifths as long as basis, which is wide and produced laterally (but not forwards) at distal end. First peraeopods with basis not nearly reaching to level of antennal notch, shorter than remaining joints together, and with plumose hairs and a long subapical spine on inferior margin; the merus is distally produced on the outer margin, is subequal in length to the carpus, a little shorter than the propodus, and barely longer than the dactylus. Second peraeopods with basis five-sevenths as long as remainder of limb; ischium distinct; carpus more than half as long again as merus, which is slightly longer than either propodus or dactylus. Basis of third peraeopods about as long as rest of limb, that of fourth and fifth pairs much shorter. First three pairs of peraeopods with a well-developed exopod; fourth pair with rudimentary exopod, which is two-jointed, the second segment minute.

Peduncle of uropoda one-third as long again as telsonic somite, and one-tenth as long again as rami; endopod almost equal in length to exopod (35 : 36), with the proximal joint twice as long as second; inner margin of peduncle and endopod with spinules and several prominent spines, six on the peduncle, five on the first joint, and one on the second; the endopod bears three apical spines, the longest nearly one-third the length of the ramus; the exopod has four apical spines (the longest half as long as the ramus), three slender spines on the inner margin, and five on the outer.

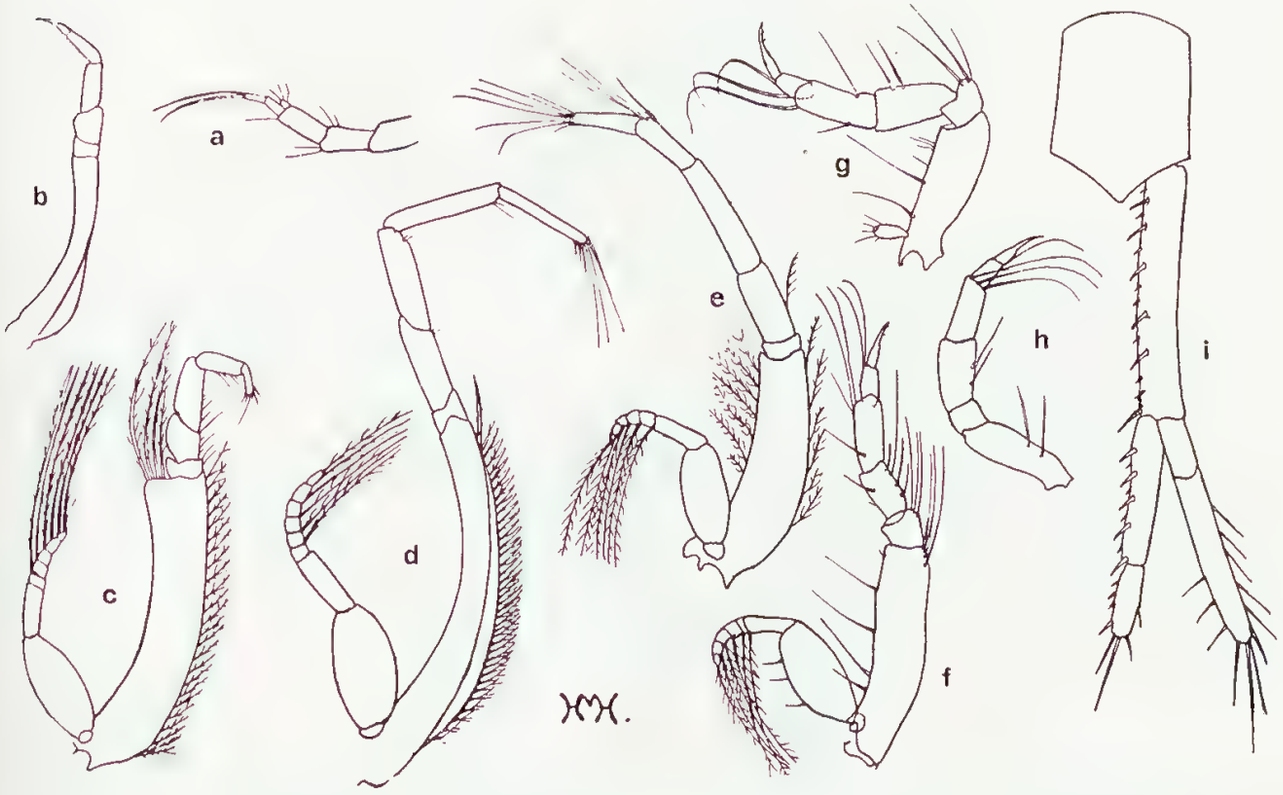

Fig. 4. *Leptocuma sheardi*, type female; a, first antenna; b and c, second and third maxillipeds; d to h, first to fifth peraeopods; i, telsonic somite and uropod (all × 37).

Colour white, with brown markings at antennal angles, termination of pseudorostral sutures, and on pleural parts of second pedigerous somite; the greater parts of the third and fourth leg-bearing somites and of the second, third, and fifth pleon somites are brown.

Length 6 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936). Type, female, in South Australian Museum, Reg. No. C. 2015.

This species is named after Mr. Keith Sheard, who has assisted in separating small Crustacea from material collected at Sellick's Reef, and to whom my best thanks are due.

A juvenile 2·75 mm. in length has the fifth peraeopods as yet undeveloped; nevertheless, the exopods of the first to fourth pairs are as in the adult female described above, and are similarly furnished with setae, long in the case of all but the rudimentary pair. It would seem that the period at which long setae appear on the exopods varies in different species. In some subadult Nannastacids they are not developed, and in a relatively large male of *Dic lasiodactylum* (described elsewhere in this paper) they are very short.

L. sheardi apparently resembles *L. minor* Calman rather than the other two Australian species, *L. pulleinei* Hale (South Australia) and *L. australiae* Zimmer (Western Australia); from both of these it may be separated at a glance by the proportions of the first and second peraeopods and uropods.

GEPHYROCUMA gen. nov.

Pseudorostral lobes contiguous in front of ocular lobe. Eye present. First antennae with three-jointed peduncle and with accessory flagellum rudimentary. Second antennae of male (submature) with flagellum composed of short joints. Mandible with long spine row. Branchial leaflets few. Third maxillipeds with well-developed exopod in both sexes and with apex of basis greatly expanded and apically produced on inner side. Peraeopods similar in both sexes: first pair massive, with ischium and carpus expanded; first and second pairs with well developed exopods; third pair with small, two-jointed exopod without long setae, and fourth with a rudimentary, single-jointed exopod. Male with five pairs of pleopods.

Pleural parts of second to fourth pedigerous somites backwardly produced, expanded and generously overlapping bases of peraeopods. Fifth pleon somite not distinctly longer than any of the others, and telsonic segment produced between bases of uropods.

Genotype: *Gephyrocuma pala* sp. nov.

Outstanding features of the genus are furnished by the character of the maxillipeds and first peraeopods.

GEPHYROCUMA PALA sp. nov.

Subadult female. Integument moderately firm. Carapace deeper than wide, equal in length to the pedigerous somites together, and longer than pleon; with an obsolete, longitudinal dorsal carina, otherwise without sculpture. Pseudorostral lobes meeting for a short distance, each apically truncate in dorsal view. Ocular lobe wide, subtriangular, and eyes pigmented. Antennal notch small.

Only a short dorso-lateral section of first pedigerous somite exposed; inferior margin of backwardly produced pleural portion of second twice as long as dorsal

length of the somite, and third with dorsal length very short; fourth somite twice as long as that of first to third together, and with pleural portion truncate; fifth small, only about as large as pleon somites, which are subequal in length.

First antennae with peduncle stout, the third joint longer than second, and the first longer than the other two together; flagellum two-jointed and accessory flagellum rounded, single-jointed, minute.

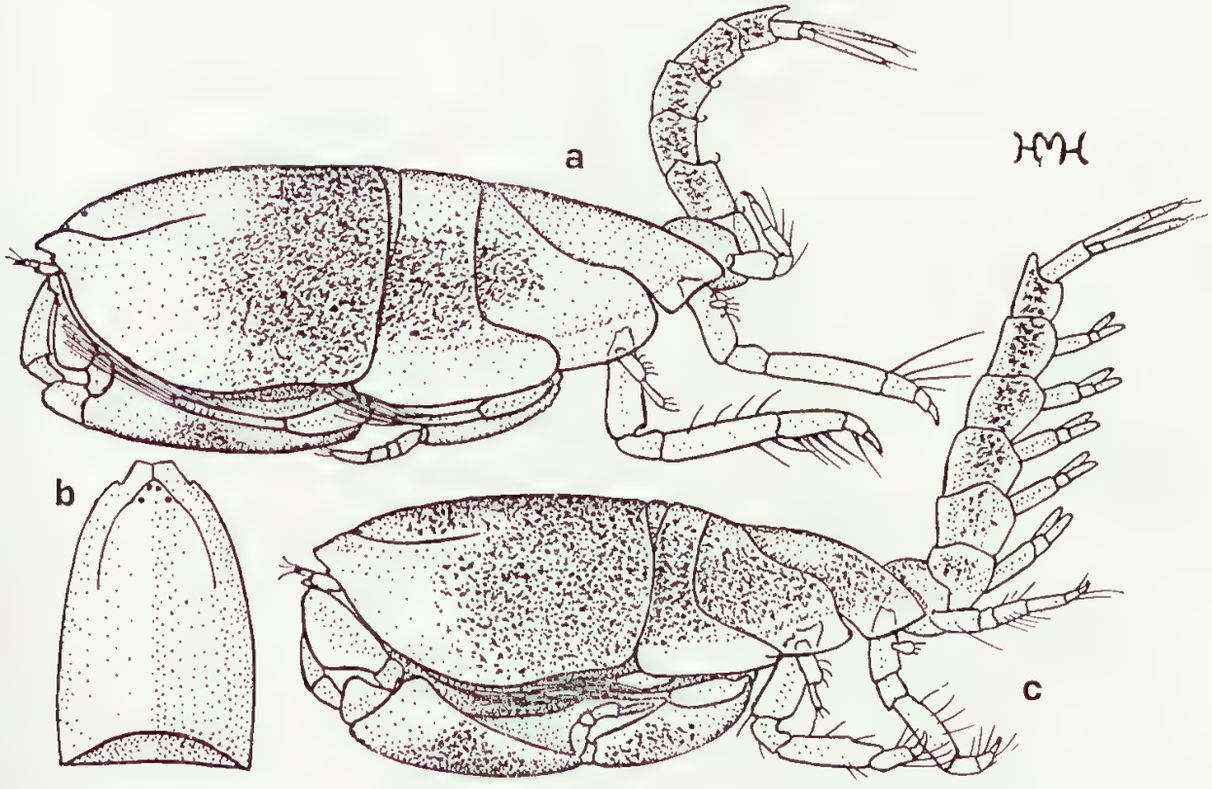

Fig. 5. *Gephyrocuma pala*, type female; a, lateral view; b, dorsal view of carapace. c, Lateral view of allotype male (all × 40).

Basis of third maxillipeds massive, and with the distal lobe very wide, apically subtruncate, and reaching to level of apex of propodus; outer apical angle with a pair of plumose setae, and inner margin with three hooked plumose setae; palp only one-third as long as basis, with dactylus stout. First peraeopods with carpus reaching to end of pseudorostrum; basis very stout, curved, scarcely longer than rest of limb; ischium with inner part greatly expanded and produced to beyond level of articulation of carpus; merus short and carpus subtriangular in shape owing to the lamellate inner edge; propodus widest distally, longer than carpus, and twice as long as ischium and merus together; dactylus only half as long as carpus. Second peraeopods with basis stout, one-third as long again as the remaining segments together; ischium and carpus short, merus and propodus subequal in length, each shorter than dactylus. Third and fourth legs each with merus elon-

gate and as long as the basis; ischium and carpus approximately equal in length. Fifth legs shorter, with merus and carpus elongate, subequal in length.

Peduncle of uropods somewhat shorter than telsonic somite, and half as long as the rami, which are subequal in length and practically unarmed; endopod two-jointed, the second segment nearly two-thirds as long as the first.

Ground colour of first and second peraeopods, and of anterior portion of carapace, yellow, of remainder of animal white. Cephalothorax, bases of first two pairs of legs and pleon boldly splashed with dark brown, and with dendritic markings.

Length 2·5 mm.

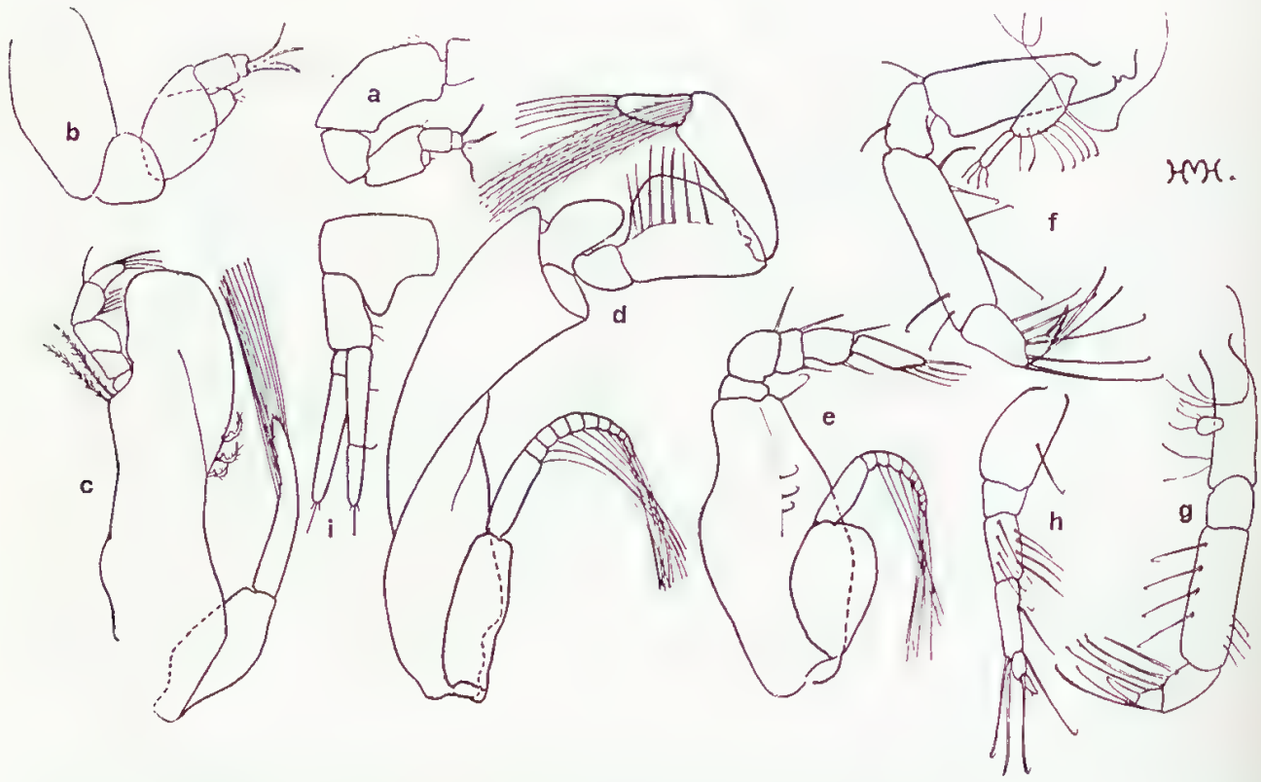

Fig. 6. *Gephyrocuma pala*. a, First antenna of paratype female. Paratype male; b, first antenna; c, third maxilliped; d to h, first to fifth peraeopods; i, telsonic somite and uropod (a and b, ×92; c to i, × 58).

Submature male. Differs from the female in the following characters. The carapace is not so deep, and the whole cephalothorax is more lightly built. The pleon is relatively larger, slightly longer than the carapace instead of a little shorter, and the infero-lateral margins of the first to fifth somites are expanded to overhang the bases of the peduncles of the pleopods. The first antennae are stouter and larger, and the lash of the second pair reaches nearly to the hinder margin of the second pedigerous somite, and is composed of numerous short joints. The first and second legs are relatively more massive.

Length 2·4 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Beach, burrowing in sand at margin of sea (H. M. Hale, Mar., Apl. and Sept., 1936), and Sellick's Reef, on sandy patch (H. M. Hale, Mar., 1936). Types in South Australian Museum, Reg. No. C. 2000, 2001.

As with *Cyclaspis pura*, *Picrocuma poecilota*, and *Leptocuma sheardi*, the colouration accords with that of the sand intermixed with dark brown fragments of *Cymodocea*.

With the legs folded, this interesting species has the form of a blunt-nosed bullet. The basis of the first legs is twisted in the beginnings of a spiral, so that the inner face fits snugly against the sides of the carapace and the preceding appendages, while the palp-like, five terminal joints of the second leg are folded back, as shown in the sketch of the male.

The first legs of Zimmer's *Vaunthomsonia* (?) *australiae* (above referred tentatively to *Leptocuma*), from North-western Australia, are similar to those of *Gephyrocuma*, but are less markedly expanded.

G. pala is the only one of the species herein recorded which was not taken on the reef, but only on the adjacent beaches. It occurs at the water's edge along the whole of the bay, three miles in length, between Sellick's Reef and Port Willunga.

PICROCUMA gen. nov.

Pseudorostral lobes contiguous in front of the wide ocular lobe. Eye present. First antennae with three-jointed peduncle and with rudimentary accessory flagellum. Mandible with spine-row short, including only four and five spines; lacinia spiniform and molar process stout; incisor portion greatly elongated, with cutting edge tridentate. Third maxillipeds furnished with exopod and not markedly differing from first peraeopods; basis not produced apically. First peraeopods short, and second to fourth subequal in length; first to third pairs with well-developed exopods in the female. Uropoda with endopod single-jointed. Second pedigerous segment much longer than the others in the ovigerous female. Adult male unknown.

Genotype: *Picrocuma poecilota* sp. nov.

The salient features of the genus are found in the structure of the mandibles and the unspecialized third maxillipeds.

PICROCUMA POECILOTA sp. nov.

Ovigerous female. Integument not highly indurated. Carapace as wide as depth, which is little less than the length; surface smooth. Pseudorostral lobes meeting in front of ocular lobe for a distance greater than length of last-named;

apically bluntly rounded in dorsal view. Ocular lobe twice as wide as long; eye darkly pigmented. Antennal notch very wide and shallow; antennal angle obtusely rounded.

All five pedigerous somites exposed; second almost as long as third to fifth together, and with pleural parts little expanded, but overlapping first and third somites.

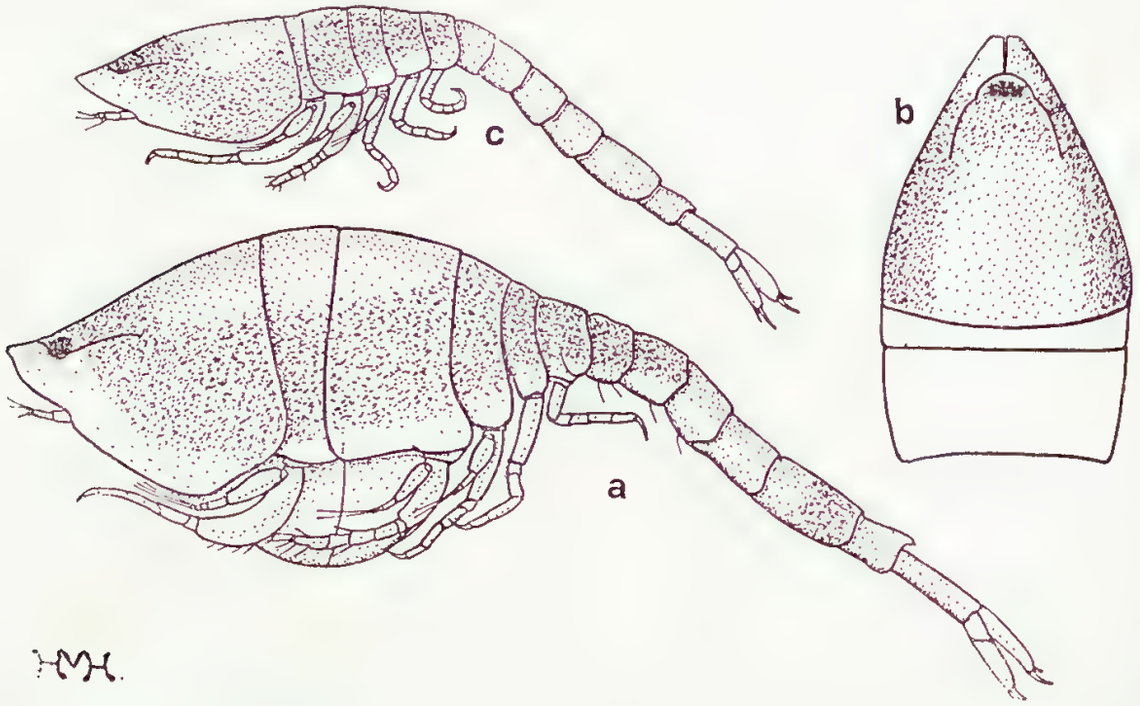

Fig. 7. *Picrocuma poecilota*, type female; a, lateral view; b, dorsal view of carapace. c, Lateral view of juvenile (all × 50).

Pleon with first to third somites successively increasing in length; fourth as long as third, and fifth much longer; telsonic somite about as long as third, scarcely produced between bases of uropods.

First antennae with first joint of peduncle very stout, not very much longer than second or third segments, which are subequal in length; flagellum two-jointed, and accessory flagellum conical, minute.

Mandible with several tufts of hair posterior to the spine-row; distance from the distal spine of row to cutting edge equal to about one-fourth of total length of mandible.

Third maxilliped resembling first peraeopod and of about same length, but with merus, carpus, and propodus stouter; basis a little shorter than rest of limb; carpus as long as ischium and merus together; propodus subequal in length to merus. First peraeopods reaching only to level of antennal notch, with joints of approximately same proportions as in third maxilliped. Second peraeopods short and stout, with ischium distinct; merus longer than carpus and shorter than dacty-

lus; propodus shorter than carpus. Last three pairs terminating in a claw, and with basis shorter than remaining joints together.

Uropods stout; peduncle nearly as long as fifth pleon somite and one-third as long again as endopod; exopod a little shorter than endopod with two terminal spines, one short and the other rather more than one-third as long as the ramus; endopod single-jointed with inner edge serrate and with terminal spines similar to those of exopod, but with the longer one slightly shorter.

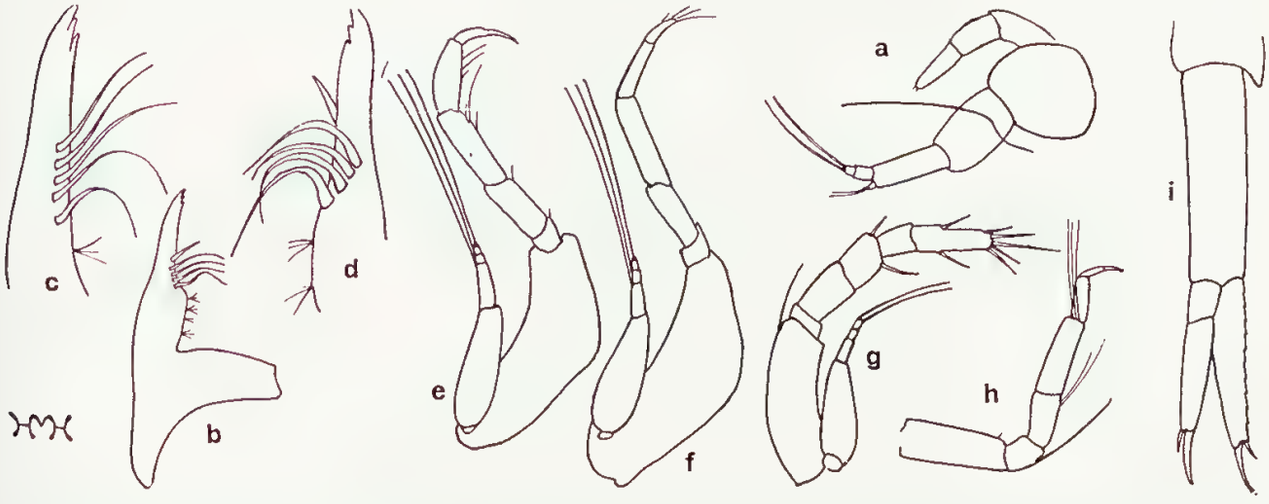

Fig. 8. *Picrocuma poecilota*, paratype ovigerous female; a, first and second antennae (× 200); b, mandible (× 200); c and d, anterior portions of both mandibles (× 450); e, third maxilliped (× 100); f, g, and h, first, second, and fifth peraeopods (× 100); i, uropod (× 100).

Colour white, boldly marked with brown.

Length 1·9 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones and in sandy patches (Mar. and Apl., 1936), and Sellick's Beach, burrowing in sand at margin of sea (H. M. Hale, Mar., Apl., and Sept., 1936). Tasmania: Wynyard, Fossil Reef, on stones (N. B. Tindale, Apl., 1936). Type, ovigerous female, in South Australian Museum, Reg. No. C. 2006.

During the periods noted above this was by far the commonest Cumacean at Sellick's Beach; it was abundant on the reef between 0–1 fathoms, and occurred everywhere in the wave-lapped sand of adjacent beaches; although many hundreds of examples were secured, all are immature, although a few subadult females are present. Mr. Tindale, however, took ovigerous females during a brief visit to Tasmania.

Juveniles 1·2–1·4 mm. (fig. 7, c) in length have the form much more slender than in the adult female, and the second to fifth peraeon somites not differing markedly in length. The uropods are, as usual, relatively shorter and stouter in the young.

FAMILY DIASTYLIDAE.

ANCHICOLURUS Stebbing.

ANCHICOLURUS WAITEI Hale.

Anchocolurus waitei Hale, 1928, p. 45, fig. 15-16.

This species was previously known only from material collected in shallow water in the south-east of South Australia. Both sexes were taken on Sellick's Reef. The carapace is marked with numerous fine ridges, which are not shown in the figure *ut supra*.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936), and Largs Bay (W. H. Baker, Nov., 1889). Tasmania: Wynyard, Fossil Reef, on stones (N. B. Tindale, Apl., 1936).

Hab. South Australia and Tasmania.

GYNODIASTYLIS Calman.

GYNODIASTYLIS SIMILIS Zimmer.

Gynodiastylis similis Zimmer, 1914, p. 189, fig. 15-16.

Zimmer described this species from a single non-ovigerous female, not quite 2 mm. in length. It proves to be rather common on Sellick's Reef, and I have before me adult males and ovigerous females, as well as subadult examples of both sexes.

The male has large exopods on the first four peraeopods. Subadult males, 1·6–1·7 mm. in length, have the exopods of the legs well developed, but the flagellum of the second antennae short and unsegmented. These immature males, and all the females, closely resemble Zimmer's specimen, excepting that the carpus and propodus of the first peraeopods are relatively wider than as shown by that author; the uropods, excluding the terminal spine of the endopod, are one-third as long again as the sixth pleon somite, the rami are subequal in length with only a few spines, and the endopod is distinctly two-jointed. In fully adult males (1·8–2 mm. in length) the uropods are relatively longer, being one-half as long again as the sixth pleon somite, and have the endopod one-third as long again as the exopod, with no apparent suture dividing it into two joints, and well armed with spines and spinules on the inner margin (see fig. 9 e). On the character of the uropods alone one might regard these males as representatives of a different species, but the other appendages so closely agree with those of females and younger males as to leave no reasonable doubt.

In the adult male the basal joint of the first antennae is barely longer than the second and third together; the flagellum is three-jointed, is about twice as long as the two-jointed accessory lash, and is equal in length to the third peduncular segment. The flagellum of the second antennae is twice as long as the peduncle, and is composed of eleven or twelve joints. The other appendages do not differ appreciably in the adults of both sexes. The mandibles have less than ten spines in the short row, and the basis of the third maxillipeds is not produced apically. In the

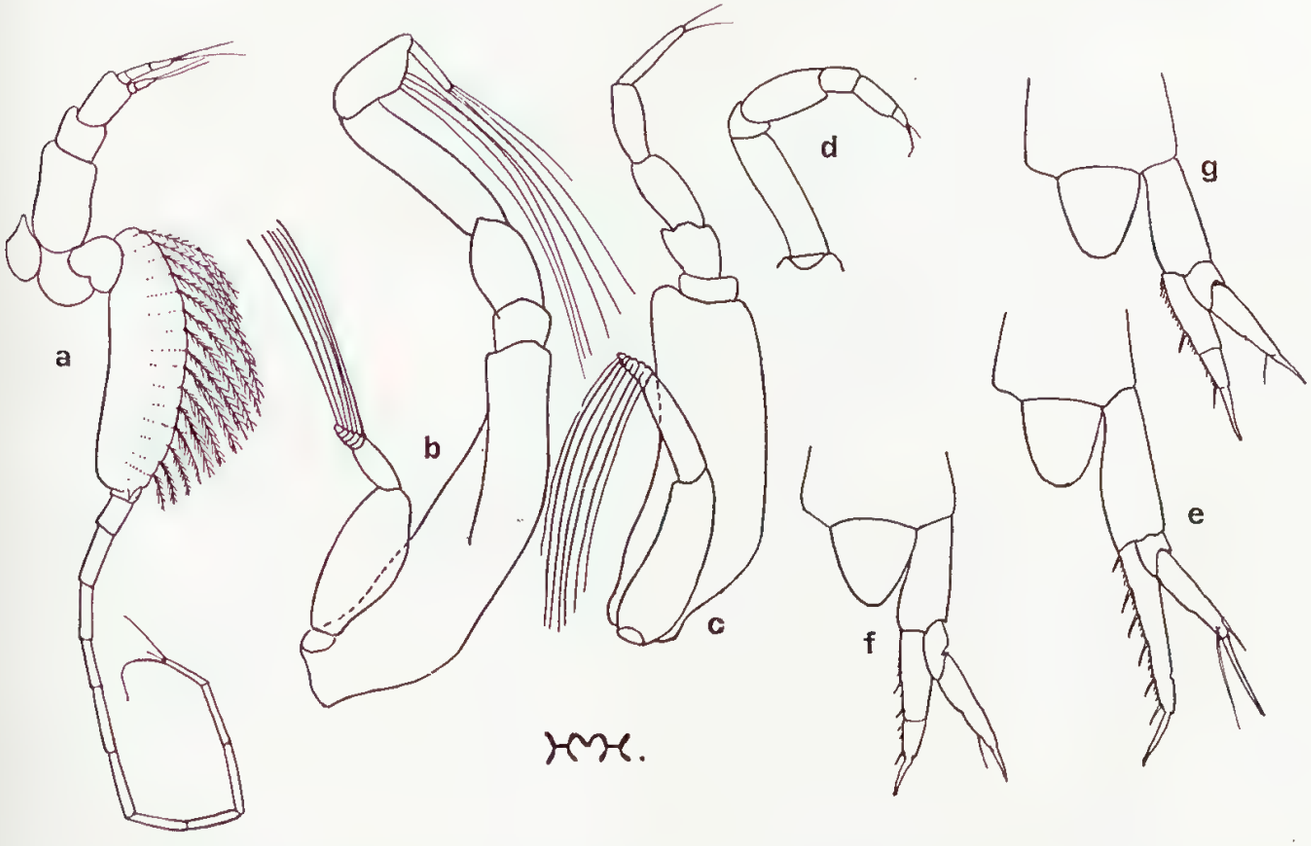

Fig. 9. *Gynodiastylis similis*. Adult male; a, first and second antennae; b, c, and d, first, second, and fifth peraeopods; e, telson and uropod. f, Telson and uropod of sub-adult male. g, Telson and uropod of ovigerous female (all × 200).

first peraeopods the basis is equal in length to the remaining joints together, and the carpus is only one-fourth as long again as the ischium and merus together. The stout basis of the second peraeopods is a little longer than the rest of the limb; the ischium is well developed, and the carpus is a little longer than the propodus, which is subequal in length to the dactylus. The basis of the fifth peraeopods is shorter than the rest of the limb.

Ovigerous females are 2–2·15 mm. in length.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936).

Hab. Western and South Australia.

GYNODIASTYLIS TURGIDUS Hale.

Gynodiastylis turgidus Hale, 1928, p. 42, fig. 11-12.

Adult male. Integument firm. Carapace barely more than one-third total length, with numerous, fine, lateral ridges; surface between latter reticulate.

First pedigerous somite partly concealed. Third segment of first antennae longer than second, and basal joint longer than either; inner flagellum two-jointed; outer lash four-jointed, and almost as long as third peduncular segment.

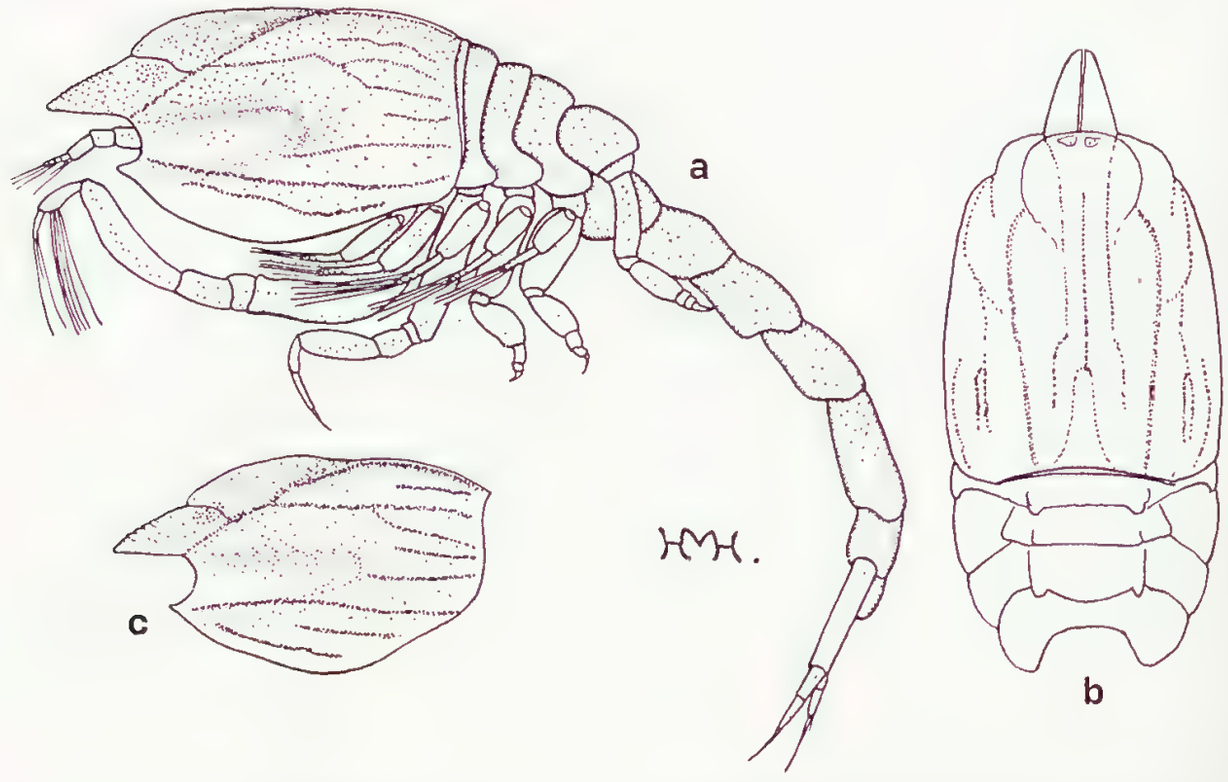

Fig. 10. *Gynodiastylis turgidus.* Adult male; a, lateral view; b, dorsal view of carapace. c, Lateral view of carapace of another male (× 50).

Terminal joint of second antennae stout, curved, and with a dense marginal fringe of hairs; flagellum only as long as peduncle, composed of eleven to twelve joints.

Basis of third maxilliped geniculate, one-third as long again as remaining segments together, widened proximally but not produced. First peraeopod stout, with carpus reaching to level of apex of pseudorostrum; basis widened at proximal third, bent outwards, and shorter than rest of limb; ischium shorter than merus, the two together less than half as long as the stout carpus, and subequal in length to propodus, which has a dense fringe of long setae on the inner margin of its widened distal portion; dactylus much shorter than propodus, with long

apical setae. There is no marked interval between the second and third legs as in the ovigerous female. Basis of second to fourth legs expanded, in the second and third with a rebate into which the exopod fits. Second peraeopod with basis shorter than the rest of the limb, and about two-thirds as wide as long; ischium distinct; merus more than two-thirds as long as carpus, and dactylus slender, without the spine as long as the merus and longer than propodus. Third peraeopods with basis almost as wide as long, and longer than rest of limb. Basis of fourth legs about as long as remainder of limb, and also very wide. Fifth legs with basis about equal in length to remaining joints together, and relatively slender.

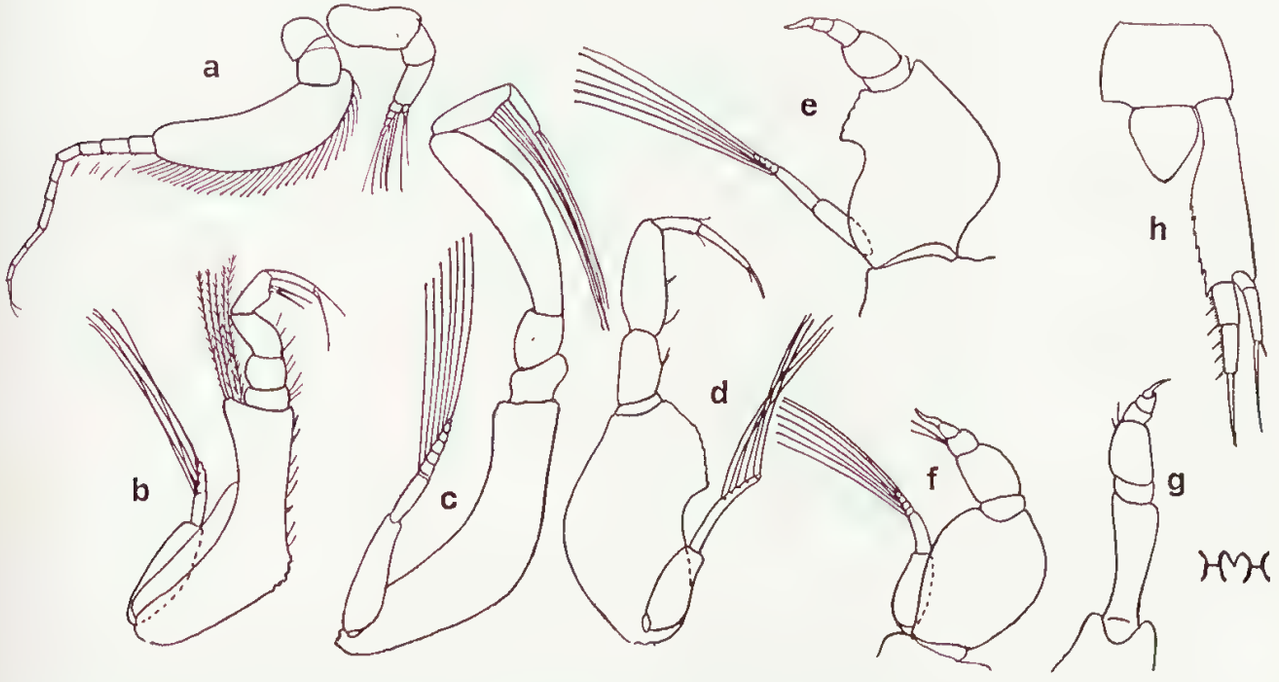

Fig. 11. *Gynodiastylis turgidus*, adult male; a, first and second antennae; b, third maxilliped; c to g, first to fifth peraeopods; h, telson and uropods (all × 60).

Peduncle of uropods stout, nearly three times as long as telson, and as long as fifth pleon somite; exopod three-fifths as long as endopod, with two terminal spines, one longer than the endopod, the other very short; endopod one-half to less than two-thirds as long as peduncle, its segments subequal in length, the first with two spines on inner margin, the second with two on inner margin and two apical spines, one of the latter short and the other as long as endopod.

Colour white.

Length 2·1–2·3 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936); 3 miles off Semaphore, bottom dredge in 5-7 fath. (B. C. Cotton, Nov., 1931).

The species was previously known only from the female. A male was taken by Mr. Cotton, and both sexes were found on stones at Sellick's Reef. The first peraeopods of the female have long terminal hairs as in the male.

Smaller males than those described above have the carapace shaped more as in the female (fig. 10, c), although the difference is really very slight.

DIC STEBBING.

DIC LASIODACTYLUM Zimmer.

Dic lasiodactylum Zimmer, 1914, p. 193, fig. 17-18.

A number of females and immature males, 1·75 mm. to 2 mm. in length or a little more, agree with Zimmer's description and figures. The first peraeopods are variable in length; in some examples they are as long as the thorax and first five pleon somites together, whereas in others they are shorter, as in the ovigerous female figured by Zimmer.

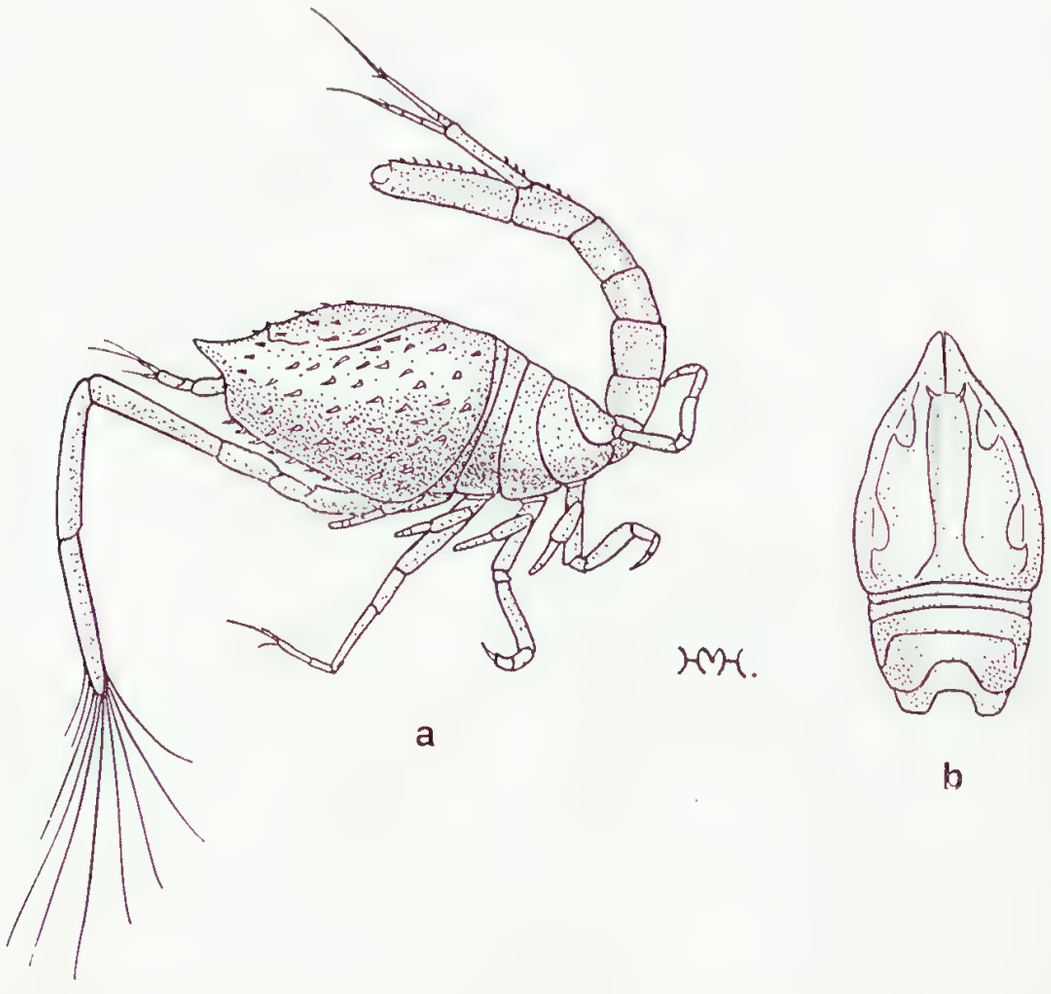

Fig. 12. *Dic lasiodactylum*, male; a, lateral view; b, dorsal view of cephalothorax (× 30).

A male, 3 mm. in length, taken in company with these smaller examples, is so different that one was at first inclined to regard it as representing a different species. It is not fully mature; the second antennae reach only a little beyond the posterior margin of the carapace, and have the flagellum stout and composed of only a few joints, while the exopods of the thoracic appendages have no long hairs.

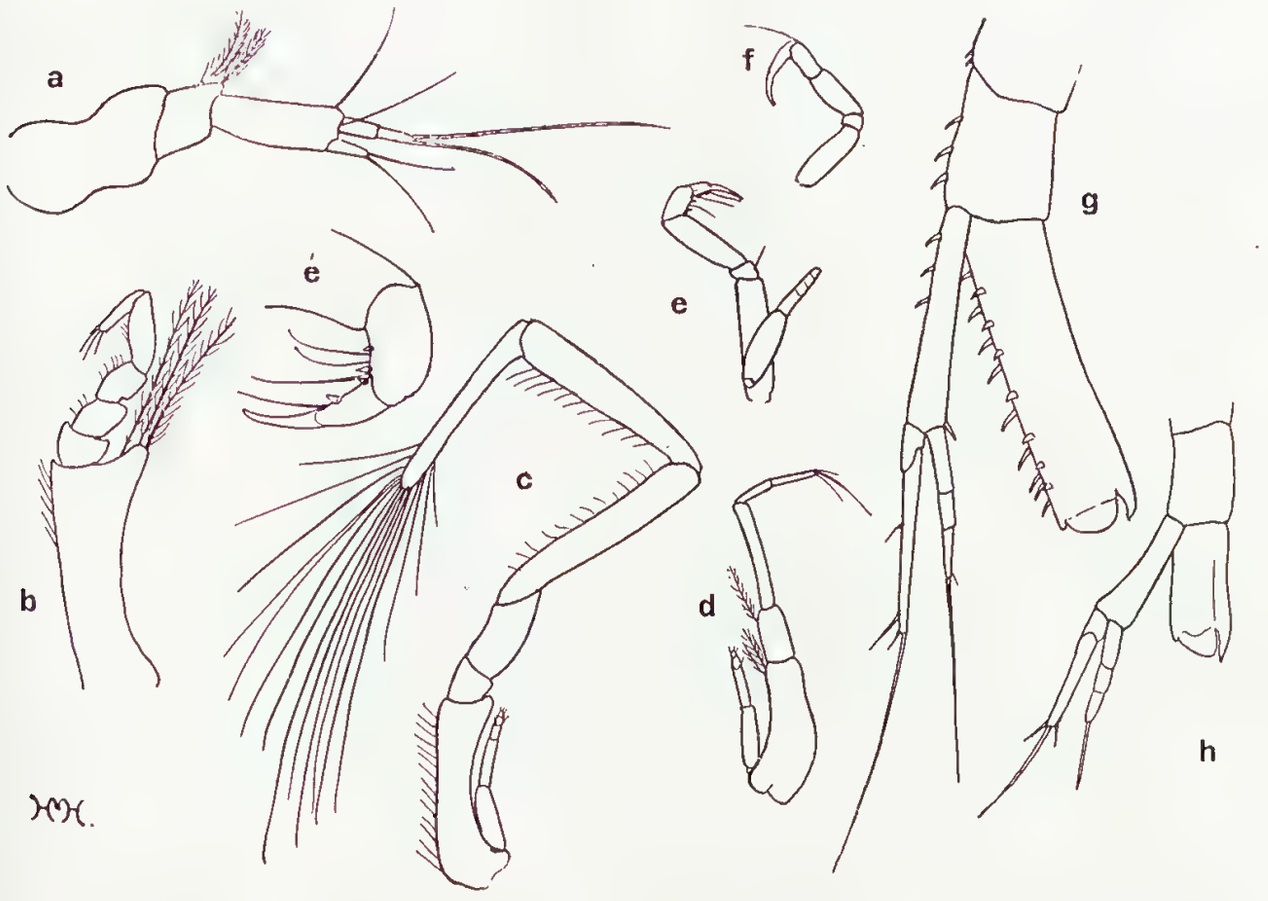

Fig. 13. *Dic lasiodactylum*. Male 3 mm. in length; a, first antenna (× 115); b, third maxilliped (× 57); c to f, first, second, third, and fifth peraeopods (× 41); e', terminal part of third peraeopod (× 115); g, telsonic somite and uropod (× 57). h, Telsonic somite and uropod of male 1·75 mm. in length (× 57).

The carapace is covered with very small spines interspersed with which are some larger spines; there is a shallow, median, dorsal trough. The first antennae have the second peduncular joint only half as long as the third; the two-jointed flagellum terminates in two long jointed filaments. The mandibles have seven and eight spines in the spine-row; the anterior part is slender, with the cutting edge narrow. The first peraeopods have the basis only about one-fourth as long as the rest of the limb, the carpus and the propodus of about the same length, and the dactylus a little shorter. The second peraeopods have the ischium suppressed and the carpus elongate, longer than propodus and dactylus together. The last three pairs of

legs have the dactylus claw-like, and the terminal joints are armed with a few short, stout spines.

This large male differs most strikingly from smaller males and females, however, in the proportions of the telson and uropods. As in the other described species of the genus (*D. calmani* Stebbing and *D. tubulicauda* Calman—see Stebbing, 1913, pp. 160-161) the telson is much longer than the sixth pleon somite, and than the peduncle of the uropods. The three-jointed endopod of the uropods is about four-fifths as long as the exopod, and its long terminal spine is considerably longer than the ramus; the exopod is shorter than the peduncle, and its spine is longer than the latter; the peduncle is furnished with a few spines, and is less than three-fourths as long as the telson, which is armed inferiorly with large spines.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936). Tasmania: Wynyard, Fossil Reef, on stones (N. B. Tindale, Apl., 1936).

Hab. South-western and southern Australia.

PACHYSTYLIS Hansen.

PACHYSTYLIS VIETUS sp. nov.

Ovigerous female. Integument moderately indurated. Carapace half as wide again as deep, and one and two-third times as long as pedigerous somites together; dorsum with a pair of fold-like, convergent ridges meeting behind the ocular lobe; each side with a similar outstanding carina; surface covered with closely-set spin-

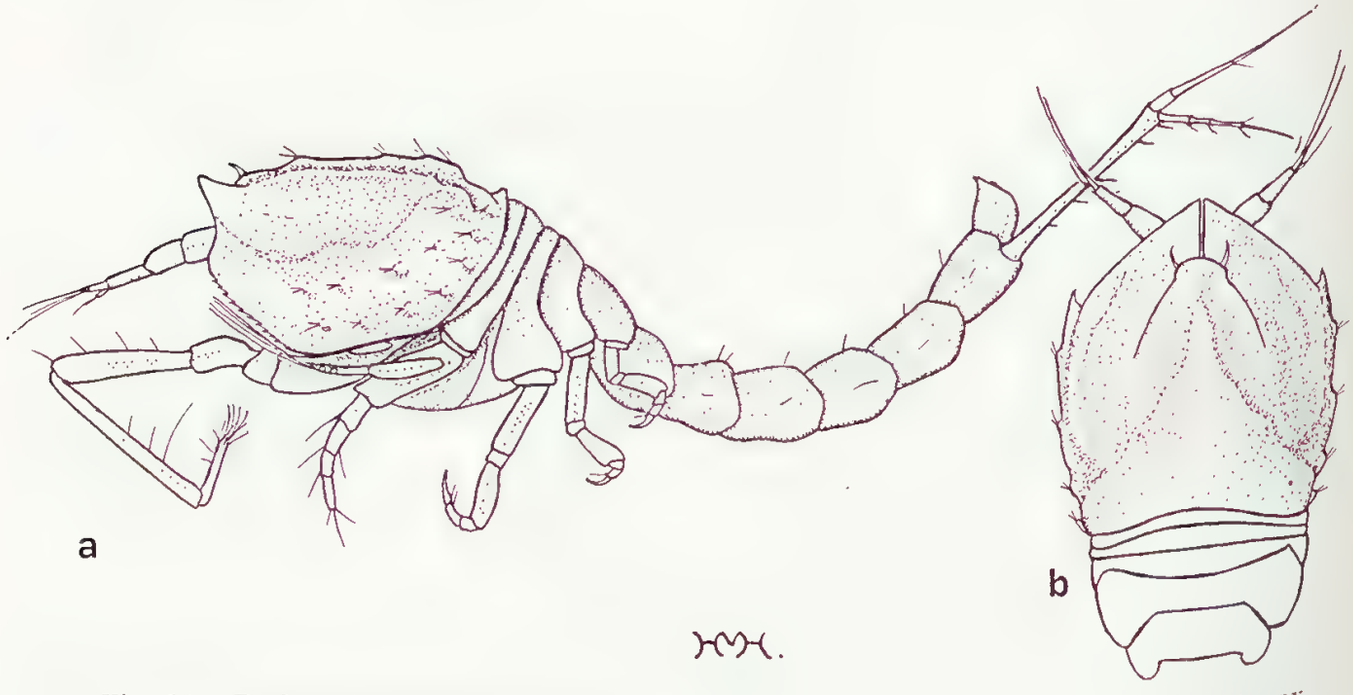

Fig. 14. *Pachystylis vietus*, type female; a, lateral view; b, dorsal view of cephalothorax (× 33).

ules, and with sparse hairs set on small elevations. Pseudorostral lobes broad, pointed anteriorly, and meeting for almost one-fifth of total length of carapace. Ocular lobe wide, rounded and armed with a pair of spines; eye not discernible. Antennal notch not well marked, and antennal angle rounded.

First pedigerous somite exposed, short; second and third somites equal in length to first dorsally, but with pleural parts expanded, the inferior margin of the third being longer than in any of the others; dorsal length of fifth somite greater than that of fourth, and equal to that of second and third somites together.

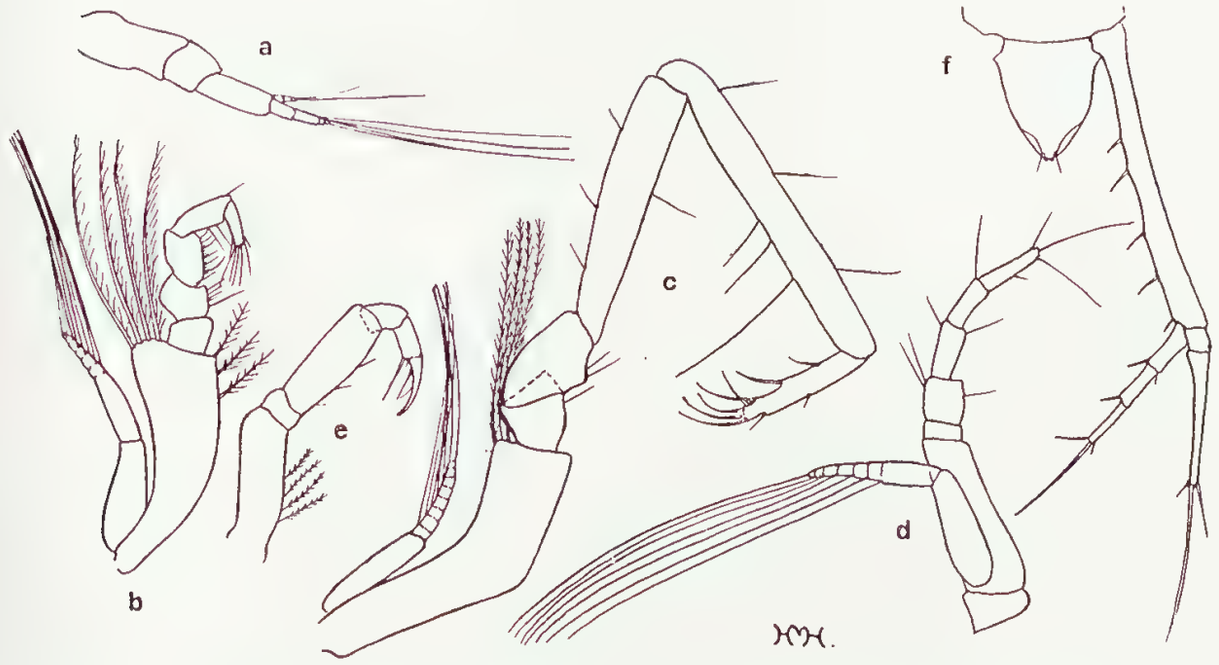

Fig. 15. *Pachystylis victus*, type female; a, first antenna; b, third maxilliped; c, d, and e, first, second, and third peraeopods; f, telson and uropod (all × 62).

First to sixth pleon somites not markedly differing in length; telson not much more than half as long as preceding somite, with a pair of exceedingly short, blunt, apical spines, and a pair of setules.

First antennae with first joint of peduncle five-sixths as long as second and third together; third much longer than second; flagellum four-jointed, as long as third peduncular joint; accessory flagellum three-jointed. Mandibles with ten spines in the spine-row.

Third maxilliped with basis curved, considerably widened distally but not produced, and equal in length to remainder of appendage; carpus longer than ischium or merus, slightly shorter than propodus, and about as long as dactylus. First peraeopods long, more than two-thirds as long as the whole animal, and with the merus reaching to level of pseudorostral lobes; basis strongly geniculate, a

little widened distally but not produced, and not much more than one-third as long as the rest of the limb; carpus shorter, and propodus longer, than basis; dactylus one-half as long as carpus, and equal in length to ischium and merus together. Second peraeopods with basis more than three-fourths as long as remainder of limb; ischium distinct, this joint and the merus wider than the three terminal joints, which do not differ much in length. Basis in three posterior legs about as long as ischium and merus together.

Peduncle of uropods slender, as long as the telson and two preceding pleon somites together, and twice as long as rami; with five spines on inner margin; endopod with the three joints subequal in length, each with a subapical spine on inner edge; apical spine of endopod about as long as the two terminal joints; exopod barely longer than endopod, with the apical spine as long as the ramus.

Colour white.

Length 2·4 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Mar., 1936). Type in South Australian Museum, Reg. No. C. 2017.

The genus was previously known from a single species.

ALLODIASTYLIS gen. nov.

Like *Gynodiastylis* Calman (1911, p. 367), but differs in having the first antennae relatively much more developed in both sexes, and with the accessory flagellum relatively large. Further, the telson is larger, with a pair of well-developed apical spines in the male, and the third legs are not widely separated from the second in the adult female.

The male has no pleopods, and has well-developed exopods on the third maxillipeds and on the first four pairs of peraeopods. The endopod of the uropoda is two-jointed, and the telson has no lateral spines. As in some species of *Gynodiastylis* the ischium of the second legs is obsolete, and the telson of the female has a pair of rudimentary apical spines. I can find no exopods on any of the peraeopods of the female, or on the third maxillipeds, but it is only fair to add that the single specimen is in a dirty condition.

Genotype: *A. cretatus* sp. nov.

ALLODIASTYLIS CRETATUS sp. nov.

Ovigerous female. Integument indurated, chalky white. Carapace not much more than one-third total length, its depth equal to greatest breadth, which is one-half its length; dorsal margin sinuate, serrate, and inferior margin serrate; each side with a dorso-lateral ridge. Pseudorostral lobes meeting in front of ocular lobe

for a distance equal to nearly one-third of length of carapace. Ocular lobe wide with colourless lenses.

All five pedigerous somites exposed, together more than one-half as long as carapace; the first short and second and third with pleural parts expanded.

First six pleon segments more or less equal in length; telson longer, terminating in a pair of inconspicuous spines.

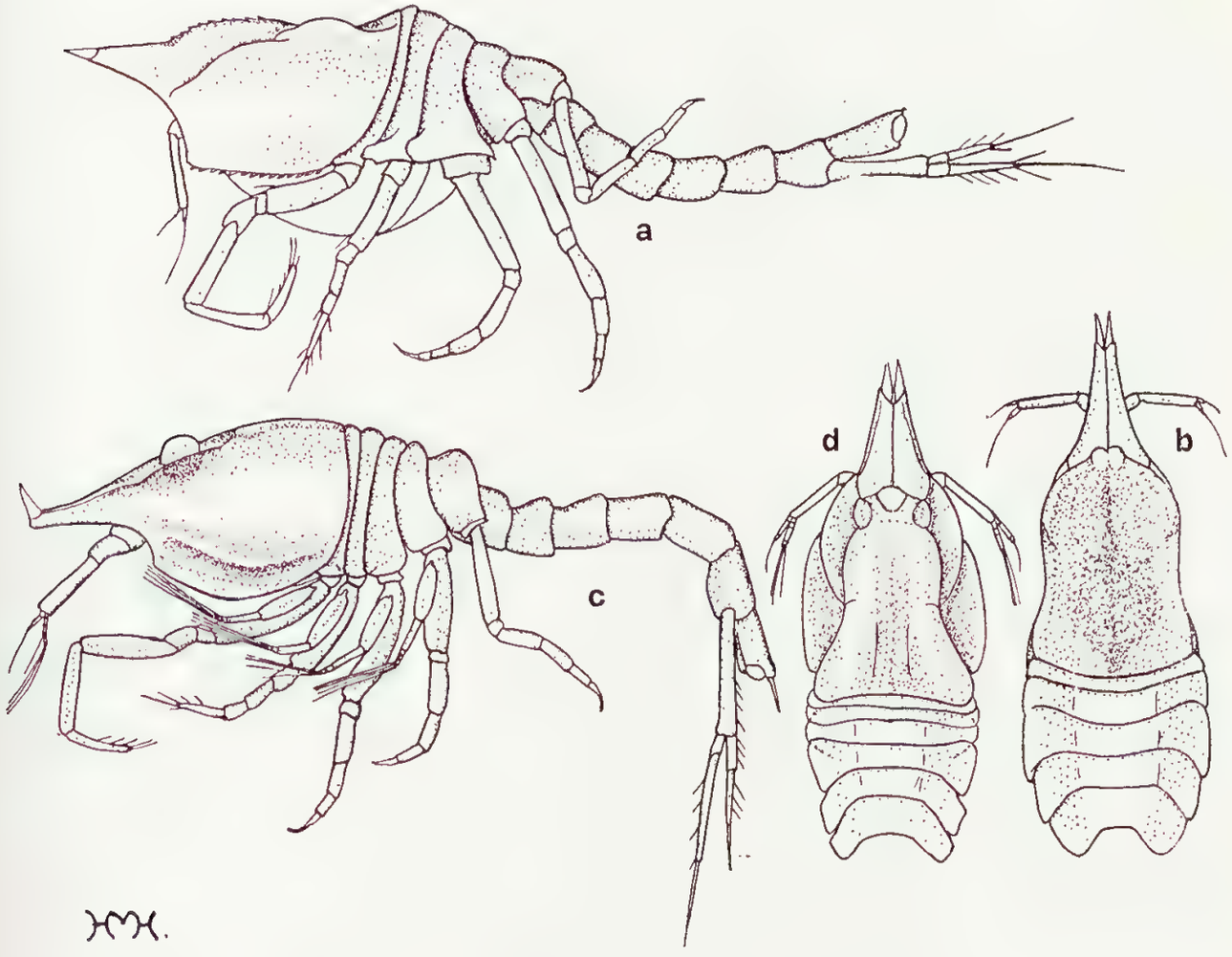

Fig. 16. *Allodiastylis cretatus.* Type female; a, lateral view; b, dorsal view of cephalothorax (× 28). Allotype male; c, lateral view; d, dorsal view of cephalothorax (× 34).

First antennae with the first joint robust, longer than the second, geniculate, and armed with a pair of short, stout spines; third joint longer than first and second segments together; flagellum four-jointed, more than one-third as long as last joint of peduncle, and twice as long as accessory flagellum, which is apparently only one-jointed. Mandible with eleven spines.

Third maxillipeds stout; basis shorter than palp, apically considerably expanded (but not forwardly produced), and furnished with long plumose setae;

merus, carpus, and propodus of approximately equal length, dactylus a little shorter. Coxae of peraeopods large. First peraeopod on left side reaching beyond apex of pseudorostrum, with basis only one-third as long as remainder of

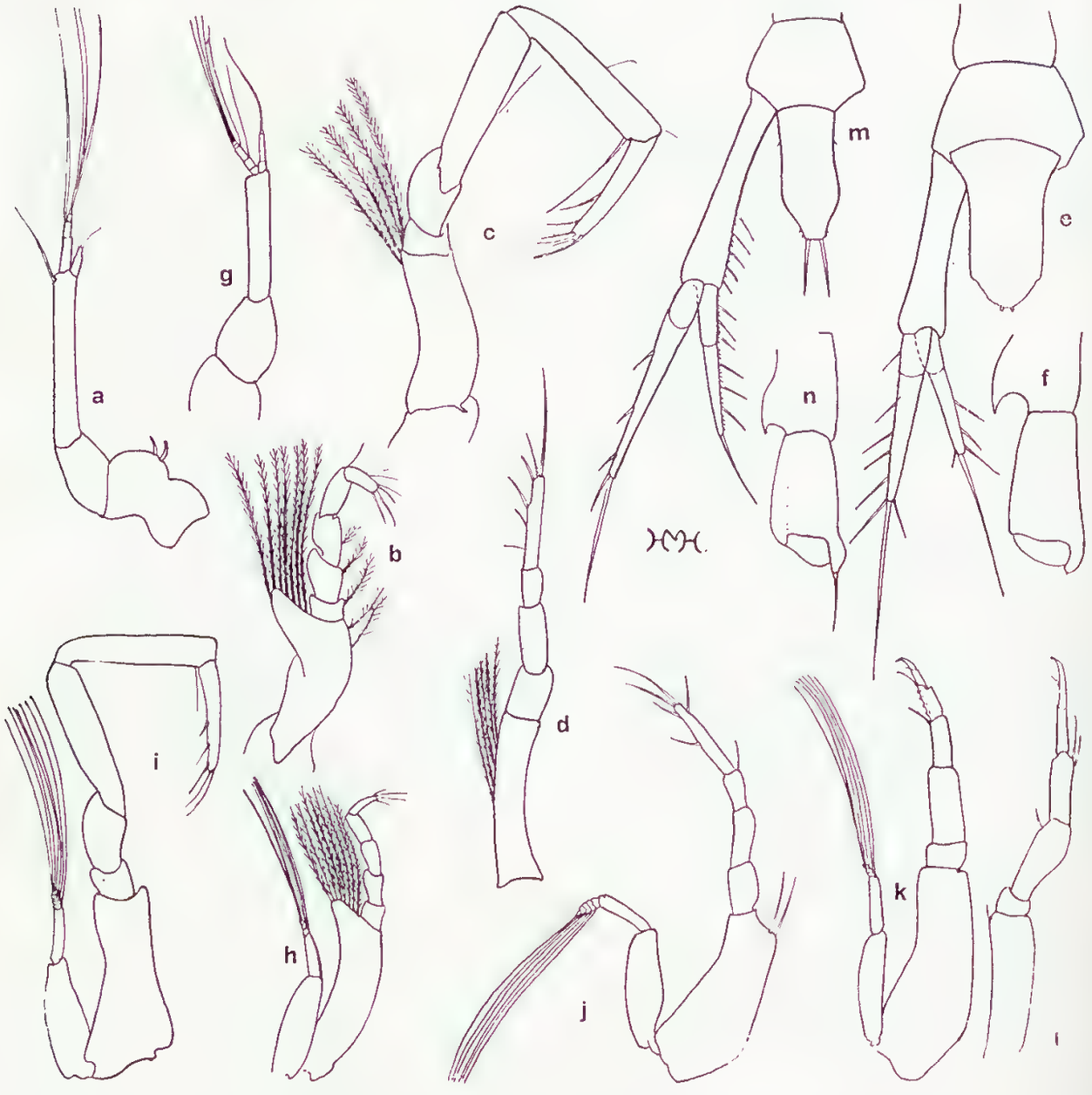

Fig. 17. *Allodiastylis cretatus*. Type female; a, first antenna; b, third maxilliped; c, first peraeopod of left side; d, second peraeopod (all × 62); e, dorsal view of telson and uropod (× 45); f, lateral view of telson. Allotype male; g, first antenna; h, third maxilliped; i to l, first, second, third, and fifth peraeopods (all × 62); m, dorsal view of telson and uropod (× 45); n, lateral view of telson (× 45).

limb; carpus and propodus subequal in length, each more than half as long again as dactylus. First peraeopod of right side apparently regenerated, with the three terminal segments considerably shorter. Second peraeopod with basis narrow,

two-thirds as long as rest of limb; dactylus more than twice as long as propodus. Third to fifth legs with merus longer than any of other joints apart from basis. Fifth legs more slender, but not shorter, than others.

Peduncle of uropods slightly longer than telson; exopod subequal in length to peduncle, with a terminal spine as long as ramus, and with several slender spines on outer margin; endopod about two-thirds as long as exopod, with the first joint approximately two-thirds as long as second, with a terminal spine as long as the ramus, and with several spines on inner margin.

Length 3 mm.

Male. Differs from the female as follows. Integument translucent, brittle. Dorso-lateral and infero-lateral areas of the carapace each with an elevated ridge. Eyes larger. Telson less stout, and with a pair of apical spines, each of which is half its length. First antennae stouter, with the accessory flagellum three-jointed and as long as the five-jointed flagellum. Third maxillipeds narrower, with exopod as long as basis. Basis of first to fourth peraeopods wider, but proportions of joints as in female. Uropods with a few spines on inner margin of peduncle, and with more numerous spines on inner margin of endopod.

Length 2·4 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936). Types in South Australian Museum, Reg. No. C. 2019, 2020.

An adult male and female, and a juvenile 1·2 mm. in length, were taken; in the last-named the eye is pigmented.

Family NANNASTACIDAE

Schizotrema Calman.

Schizotrema bifrons Calman.

Schizotrema bifrons Calman 1911, p. 362, pl. xxxiv, fig. 18-21.

The carapace bears scattered tubercles and small spines, or small spines only. The second and third joints of the peduncle of the first antennae are subequal in length, each less than half as long as the geniculate first joint; the flagellum is two-jointed. The third maxillipeds have the basis very wide and produced apically, while the merus also is considerably expanded and produced; there is a long apical spine (as well as plumose hairs) on the merus and carpus. The basis of the first peraeopods is less than half as long as the remaining joints together, and is armed with a row of moderately large spines in addition to small spines; the carpus is

slightly shorter than the propodus. The second peraeopods have the basis wide, not much shorter than rest of limb, and armed with a row of very large spines; the carpus is more than twice as long as the propodus, and subequal in length to the dactylus.

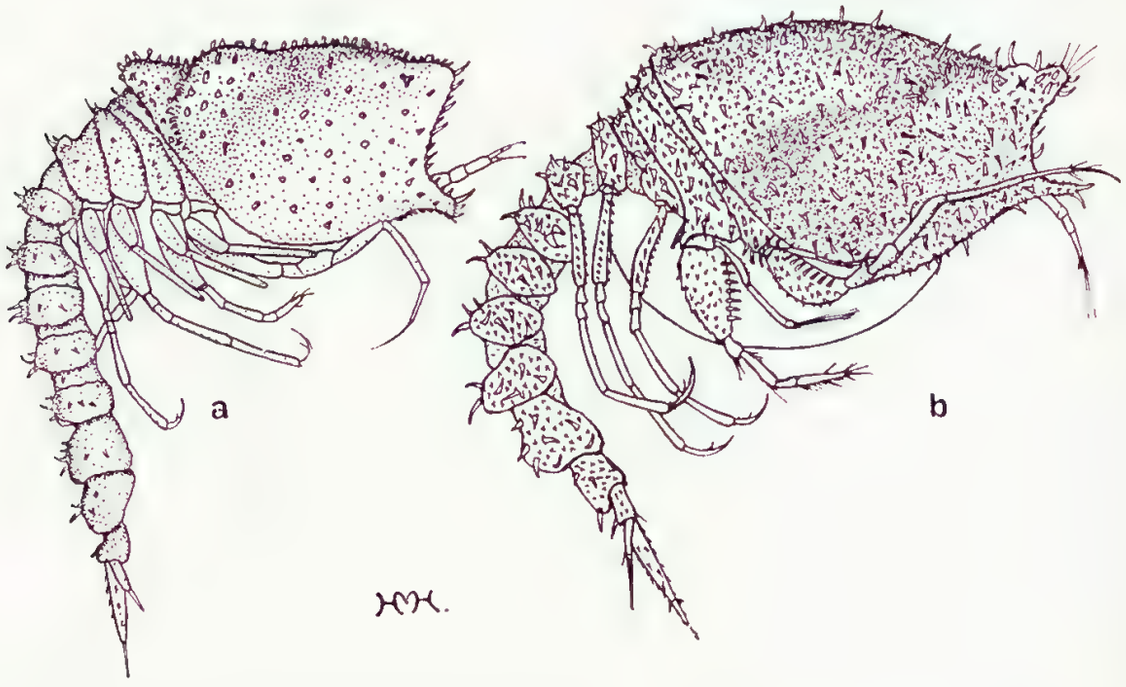

Fig. 18. *Schizotrema bifrons*; lateral views of (a) male and (b) female (× 60).

The male differs from the female in having the carapace not so deep, the accessory flagellum of the first antennae larger, and the third and fourth peraeopods with widened basis. There are well developed exopods on the first to fourth legs.

The branchial regions of the carapace are swollen in both sexes, but the tumidities are much more developed in some specimens than in others.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Jan., Mar., and Apl., 1936).

Hab. India and Southern Australia.

SCHIZOTREMA BIFRONS Calman var. ACULEATA var. nov.

Some examples of both sexes, both juvenile and adult, differ consistently in having the spiny armature much more developed, and for these the varietal name *aculeata* is proposed.

The accompanying figures of the appendages of the variety would illustrate equally well those of short-spined typical specimens.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Mar. and Apl., 1936). Type in South Australian Museum, Reg. No. C. 2048.

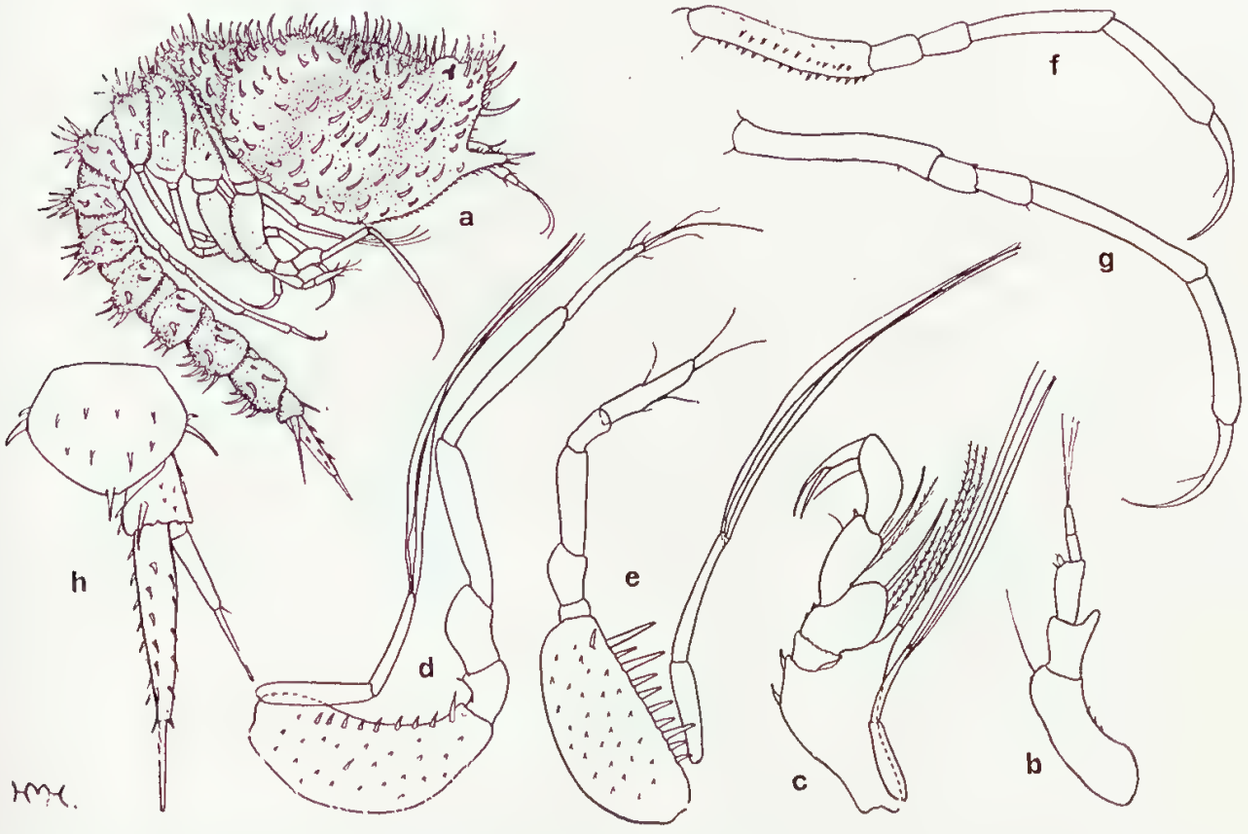

Fig. 19. *Schizotrema bifrons* var. *aculeata*, type female; a, lateral view (× 43); b, first antenna; c, third maxilliped; d to g, first, second, third, and fifth peracopods; h, telson and uropod (all × 120).

NANNASTACUS Spence Bate.

NANNASTACUS HANSENI Calman.

Nannastacus hanseni Calman, 1905, p. 11, fig. 1, a-e; Stebbing, 1913, p. 172.

Two males were found burrowing in a layer of sand on a stone. In one of these the spiny armature is more strongly developed than in the specimen figured by Calman; the "low rounded tubercles" of the carapace are higher, and many of them have become short spines, which are particularly prominent at the posterior portion of the carapace. The subcylindrical dorsal processes of the pleon are distinctly stouter, and have the apical spines longer, while several of the subapical tubercles are developed as strong spines.

In both specimens now examined the antero-lateral angle of the carapace bears a short spine.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stone, 1 fath. (H. M. Hale, Mar., 1936).

Hab. Sunda Sea and South Australia.

NANNASTACUS GIBBOSUS Calman.

Nannastacus gibbosus Calman, 1911, p. 355, pl. xxxiii, fig. 16-21; Stebbing, 1913, p. 170.

This species is not uncommon on Sellick's Reef. As noted by Calman, it varies considerably in the degree of inflation of the branchial regions and in the size of the hinder dorsal tumidity of the carapace. In one female the carapace is so swollen that its greatest width is equal to four-fifths its length, while the pleural parts of the pedigerous somites are very swollen and prominent. In some examples a hairy covering is well developed; in others it is sparse or almost entirely absent. In the male the peraeopods are much as in the female, but the basis is expanded in the third and fourth pairs, being twice as long as wide in the third legs and one and one-half times as long as wide in the fourth. The uropods do not differ from those of the female.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Jan. and Apl., 1936).

Hab. Gulf of Siam and South Australia.

NANNASTACUS ZIMMERI Calman.

Nannastacus zimmeri Calman, 1911, p. 352, pl. xxxiii, fig. 4-15; Stebbing, 1913, p. 169.

This species was taken in company with *N. gibbosus*.

Males approximately 1·6 mm. in length are as described and figured by Calman, but larger males (2·2 mm.) have the branchial regions more inflated, and there is a posterior dorsal tumidity on the carapace.

Foxon (1932, p. 392) records the related *N. suhmii* Sars from Queensland.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Apl., 1936).

Hab. Ceylon and South Australia.

CUMELLA G. O. Sars.

CUMELLA LAEVE Calman.

Cumella laevis Calman, 1911, p. 350, pl. xxxii, fig. 25-27, Stebbing, 1913, p. 182.

Ovigerous female. Carapace and pleon finely granulose. Carapace one-third the total length, its depth more than half its length; subtriangular in shape in

lateral view, and with a faint, median, dorsal carina; dorsal margin straight, slightly sinuous. Pseudorostral lobes short and truncate, meeting in front of eye-lobe for a distance equal to the width of the last-named. Antero-lateral margins almost straight, antennal notch wide and shallow, and antennal angle rounded; inferior margin serrate, with a small tooth at anterior angle.

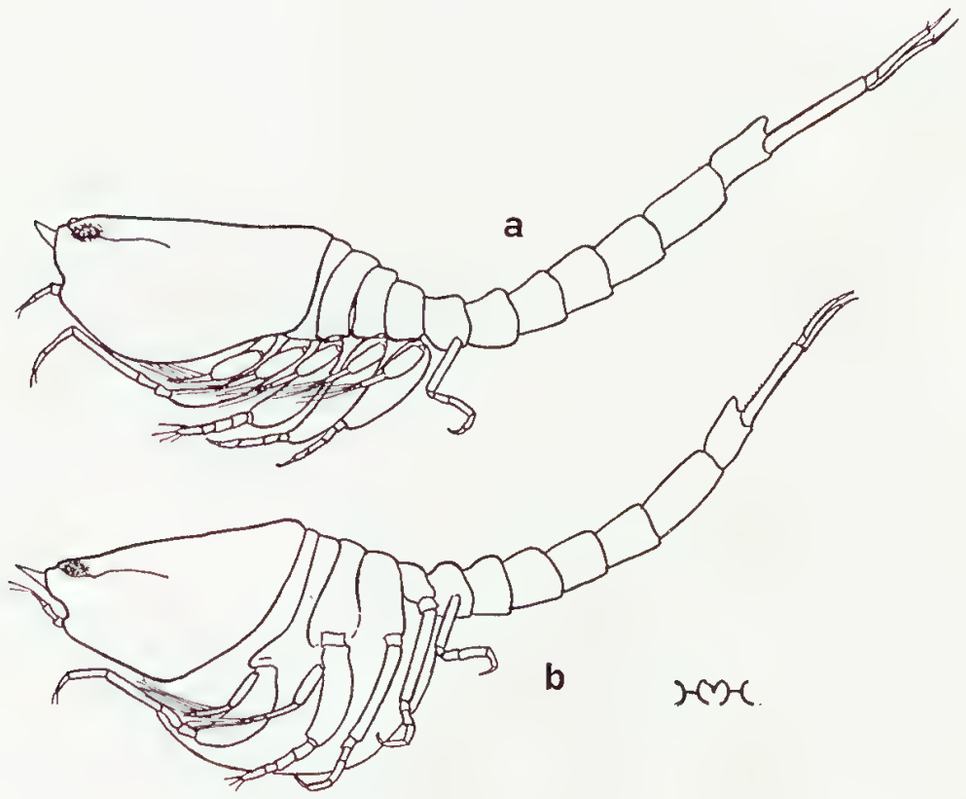

Fig 20. *Cumella laeve*; lateral views of (a) male and (b) ovigerous female (× 50).

Pedigerous somites all exposed, together two-thirds as long as the carapace.

Pleon shorter than cephalothorax, and with the first three somites slightly elevated dorsally; telsonic somite about two-thirds as long as preceding somite, projecting slightly posteriorly.

Eye pigmented. First antennae with peduncle stout, slightly geniculate, more than one and two-thirds times as long as second joint, which is subequal in length to the third, and rather more than twice as long as wide; flagellum somewhat longer than last peduncular joint, composed of two subequal segments; accessory flagellum rudimentary, single-jointed.

Third maxilliped with basis as long as palp exclusive of dactylus; ischium very short; merus strongly produced at outer apical angle, and about as long as propodus, which is one-third as long again as carpus. First peraeopod with basis curved, almost two-thirds as long as remaining joints together; carpus slightly

longer than ischium and merus together; propodus five-sevenths as long as carpus, and nearly twice as long as dactylus. Second peraeopods with basis four-fifths as long as rest of limb, and with a small stout spine near base; ischium distinct; merus and carpus subequal in length, each three-fourths as long as dactylus, the long terminal spine of which is longer than the joint; propodus barely more than half as long as carpus. Last three pairs of legs rather slender. Basis of third pair three-fourths as long as rest of limb. Fifth with basis half as long as remaining joints together; carpus half as long again as merus.

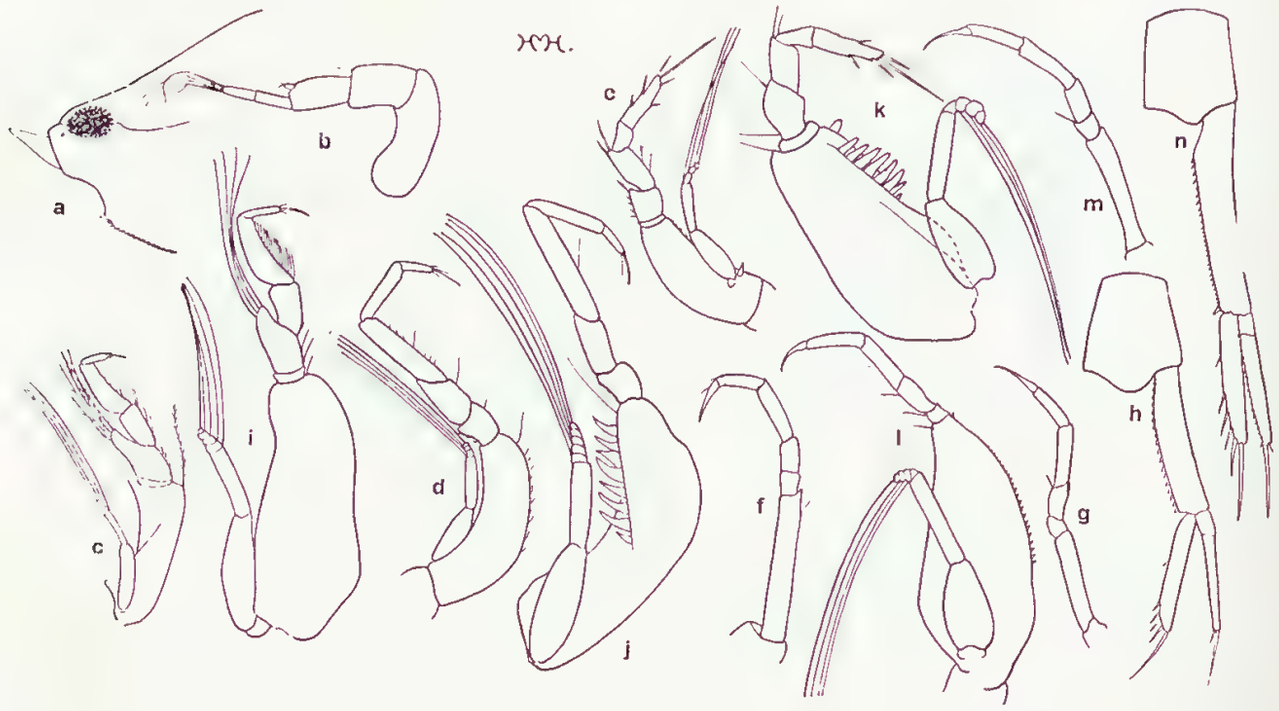

Fig. 21. *Cumella laeve*, Ovigerous female; a, lateral view of anterior portion of carapace (× 92); b, first antenna (× 150); c, third maxilliped; d to g, first, second, third, and fifth peraeopods; h, telson and uropod. Adult male; i, third maxilliped; j to m, first, second, third, and fifth peraeopods; n, telson and uropod (all × 92).

Uropods rather stout; peduncle half as long again as telsonic somite, serrate on inner edge; endopod almost as long as exopod, three-fourths as long as peduncle, with the long terminal spine half the length of the ramus, and with four subapical spines on inner margin; exopod serrate on inner margin, with apical spine about half as long as ramus.

Colour smoky grey.

Length 1·5 mm.

Adult male. The carapace is subrectangular rather than triangular in lateral view. The third maxillipeds and first to fourth peraeopods have the basis much more massive than in the female. In the third maxillipeds it is two and one-third

times as long as wide, and considerably longer than the palp. In the first peraeopods it is almost as long as the remaining joints together, and bears a row of large stout spines on the distal half. The second legs have a row of similar spines on the basis, which is nearly half as wide as long. Basis of third and fourth peraeopods about two and one-half times as long as wide, serrate on outer edge, and much longer than rest of limb. Fifth pair much as in female.

Uropods relatively longer than in female; peduncle more than two-thirds as long again as telsonic somite, and more than half as long again as endopod; terminal spines more than half length of respective rami.

Length 1·6 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Mar. and Apl., 1936).

Hab. Gulf of Siam and South Australia.

Young males resemble females in the shape of the carapace. In juveniles of both sexes the uropods have the peduncle relatively shorter, and in non-ovigerous females 1·2–1·5 mm. in length it is barely longer than the telsonic somite.

The ovigerous female described above is so exceedingly close to Calman's description of *C. laeve* that I hesitate to describe it as new. Calman's adult female differs from the specimens now examined in the following particulars:

The size is smaller (two-thirds as long as South Australian examples); the last segment of the peduncle of the first antennae is described as shorter than the preceding joint, and the basis is relatively shorter in the first and second peraeopods. The peduncle of the uropods is stated to be nearly twice as long as the telsonic somite, whereas in none of the adult females before me is it more than half as long again as this somite. Because of these differences, and because the male of *C. laeve* is unknown, the South Australian material is described and figured in some detail.

CUMELLA LIMA sp. nov.

Ovigerous female. Carapace and pleon granulose. Carapace almost one-third total length, its depth half the length, and less than greatest width; there is a large tumidity on each side, followed by a smaller swollen area, so that a lateral view of the carapace shows a depression near the hinder margin, while in dorsal view the back is fiddle-shaped; at about the first third of the length is a pair of small dorsal elevations. Pseudorostrum long, directed slightly upwards. Antero-lateral margin concave, and antennal angle quadrate. Ocular lobe wide.

Pedigerous somites all exposed, the third to fifth with dorsal tumidities.

Pleon not much shorter than cephalothorax, with the first four somites tumid dorsally; telsonic somite three-fourths as long as fifth, broadly rounded, and only slightly produced posteriorly.

Eyes black. First antennae with peduncle stout, the second joint produced distally, and the third only two and one-third times as long as wide; flagellum short, little more than half as long as third peduncular segment, two-jointed; accessory flagellum small, unjointed.

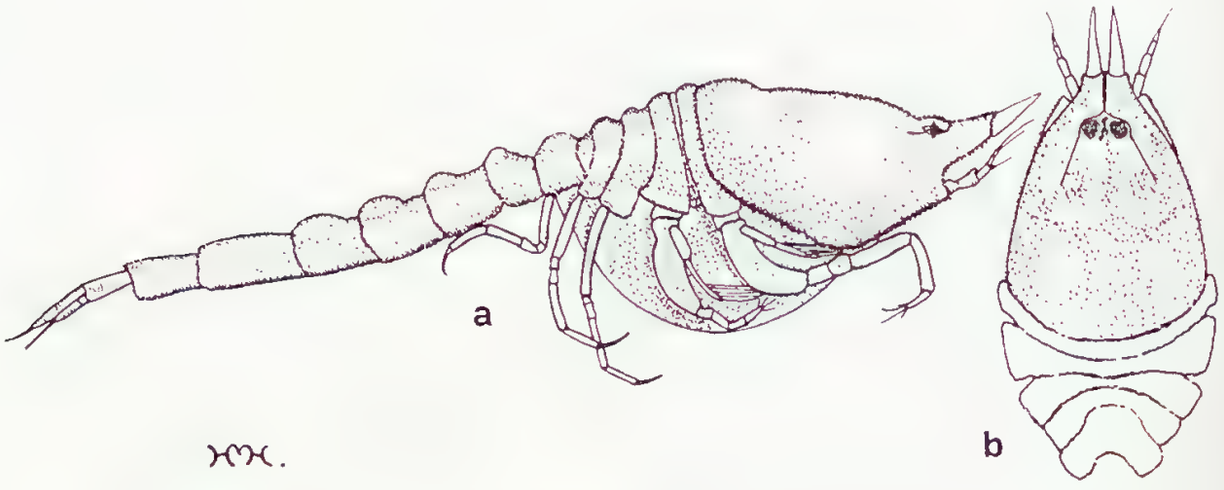

Fig. 22. *Cumella lima*, type female; a, lateral view; b, dorsal view of cephalothorax (× 53).

First peraeopods with basis not much more than half as long as rest of limb, and with merus one-half as long as carpus. Second peraeopods with the stout basis rather more than two-thirds as long as remaining segments; ischium not distinct. Third to fifth slender; basis of third equal in length to rest of limb, that of fourth and fifth shorter; fifth leg with carpus twice as long as merus, and barely four-fifths as long as basis.

Uropods stout, the peduncle three-fourths as long as the telsonic somite, and with six thorn-like projections on inner margin; endopod longer than the peduncle, terminating in a distinctly marked off, finely serrate spine, which is more than half the length of the ramus itself, and with a subapical serrulate spine about one-third as long as the terminal spine; inner margin of endopod with six to seven thorn-like spines; exopod two-thirds as long as endopod, with a slender terminal spine as long as ramus.

Colour cream.

Length 1·5 mm.

Male. The basis of the third and fourth peraeopods is greatly expanded, the breadth being equal to half the length. The carpus of the fifth leg is nearly three times as long as the merus, and not much shorter than the basis. The peduncle of the uropods is longer, being slightly greater in length than the telsonic somite; the endopod is a little shorter than the peduncle.

Length 1·6 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, on stones, 1 fath. (H. M. Hale, Mar., 1936). Tasmania: Wynyard, Fossil Reef (N. B. Tindale, Apl., 1936). Types in South Australian Museum, Reg. No. C. 2037, 2038.

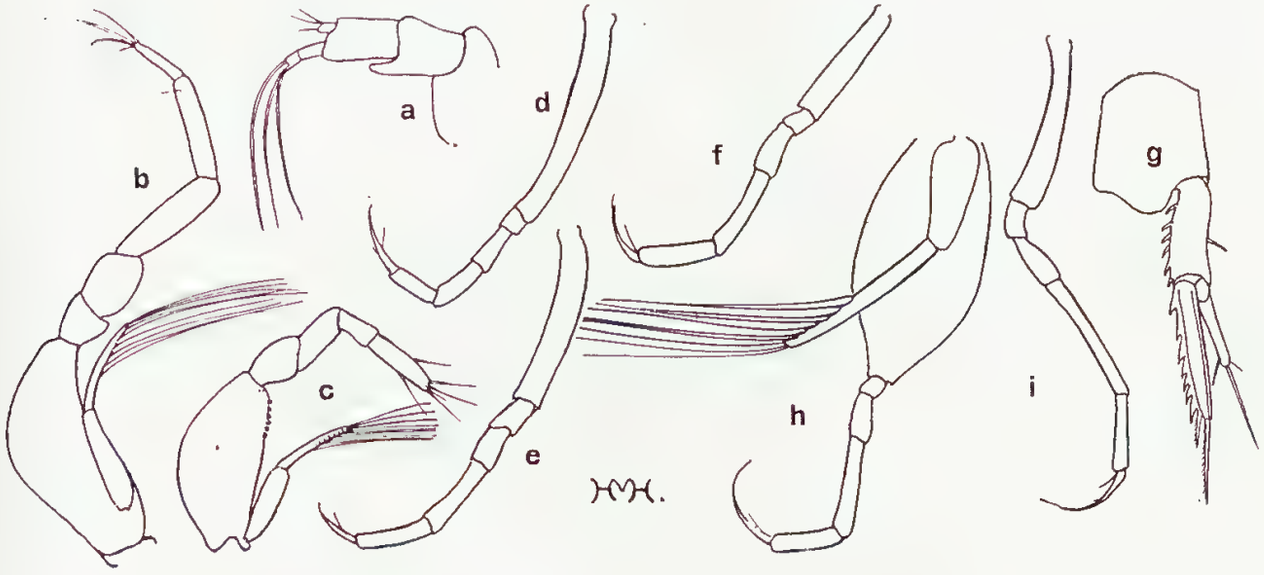

Fig. 23. *Cumella lima.* Paratype female; a, antenna (× 190); b to f, first to fifth peracopods; g, telson and uropod. Paratype male; h and i, fourth and fifth peracopods (all × 120).

This species is represented by a number of examples which resemble *C. hispida* (Calman, 1911, p. 347, pl. xxxii, fig. 15-18), but differs consistently from Calman's description in the following particulars. The size is smaller, ovigerous females being 1·4 mm. to 1·5 mm. in length (2·55 mm. Calman), while the first antennae are stouter, the third joint being twice to two and one-third times as long as wide (three times Calman). Zimmer (1914, p. 179) comments on the fact that the first antennae are stouter in the Western Australian specimens which he names as *C. hispida.* The uropoda, too, are different, for in *C. hispida* the terminal spine is indistinctly marked off from the endopod, and this ramus, together with its long spine, "measures a little more than the length of the peduncle"; in *C. lima* the endopod with its spine is one and two-thirds to twice as long as the peduncle. The armature of the uropods is not as described for *C. hispida,* and the proportions of the leg segments are different.

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Hale, Herbert M. (1928): *Trans. Roy. Soc., S. Aust.,* lii, 1928, pp. 31-48, fig. 1-17.

Hale, Herbert M. (1929) : *Crust. S. Aust.* (Brit. Sci. Guild Handbooks, *Fauna and Flora of S. Aust.*), pp. 344-355, fig. 344-353.

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Hale, Herbert M. (1936) : *Rec. S. Aust. Mus.*, v, pp. 395-401, fig. 1-6.

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Zimmer, C. (1914) : *Fauna Südwest Aust.*, v, pp. 175-195, fig. 1-18.

Zimmer, C. (1921) : *Kungl. Svenska Vet.-Akad. Hand.*, lxi (No. 7), pp. 1-13, fig. 1-16.

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Stebbing, T. R. R. (1912) : *Ann. S. Afr. Mus.*, x.

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An INTERESTING CHIRONOMID *TELMATOGETON AUSTRALICUS* sp.n. from a SOUTH AUSTRALIAN REEF

By H. WOMERSLEY, F.R.E.S., A.L.S., Entomologist, South Australian Museum.

Although the genus *Telmatogeton* of the subfamily *Clunioninae* of the *Chironomidae* has not been recorded hitherto from Australian coasts, it is represented in the Southern Hemisphere by species from the coasts of South America, South Africa, St. Paul I., and Japan. Eight species have been previously described as follows:

Telmatogeton sancti-pauli Schiner, St. Paul I., and South Africa.
Telmatogeton minor Kieffer, South Africa.
Telmatogeton torrenticola Terry, Hawaii.
Telmatogeton abnorme Terry, Hawaii.
Telmatogeton trochanteratum Edwards, Chile.
Telmatogeton simplicipes Edwards, Chile.
Telmatogeton japonicus Tokunaga, Japan.
Telmatogeton pacificus Tokunaga, Japan.

The genus is essentially marine, except for the two Hawaiian species which inhabit torrents. The species described herein is the first to be recorded from this country, and differs from all previously described forms. It was first found by Mr. H. M. Hale, frequenting the reef off Sellick's Beach, South Australia, in February, March, and April, 1936, and again by Miss Joan Campbell on the reef off Noarlunga.

The genus was erected by Schiner for the genotype *T. sancti-pauli* from St. Paul I. in the Indian Ocean. It has in recent years been better defined by Edwards, who showed that the South African species *Trissoclunio fuscipennis* Kieffer was synonymous, and also that Schiner was wrong in stating that the palpi in *T. sancti-pauli* were four-segmented, these being actually only two-segmented. Kieffer, in his monograph of the *Chironomidae* in the Genera Insectorum, placed the genus in the *Chironominae*, but it is now placed in the *Clunioninae*, a subfamily easily distinguished from all others by the absence of the anepisternal suture. The *Clunioninae* comprises a number of genera which are more or less marine in habit, and many of which are apterous or semi-apterous in one or both sexes. As some of these other genera may be found to occur along our coasts, the following key, taken from Edwards (Diptera of Patagonia and Southern Chile, Part 2, fasc. 5, Brit. Mus., 1931) is given.

KEY TO THE KNOWN GENERA OF CLUNIONINAE.

1. Fifth tarsal segment deeply trilobed at tip .. .. 2.
   Fifth tarsal segment simple or slightly bilobed .. .. .. 5.
2. Both sexes fully winged .. .. 3.
   Both sexes brachypterous .. .. 4.
3. Legs unmodified; hairs of tibiae weak .. *Telmatogeton* Schiner.
   Front legs of male modified; femora swollen; tibiae with tubercle at base; hairs of tibiae strong, sometimes flattened (West Coast North America).
   Paraclunio Kieffer.
4. Wings about as long as thorax in both sexes; halteres present (Europe).
   Psammathiomyia Deby.
   Wings and halteres minute or absent (female). (Antarctic) *Halirytus* Eaton.
5. Eyes bare; tarsi long, fourth segment cordiform and much shorter than third or fifth, second hind tarsal segment longer than third; thorax with rows of acrostichal hairs continued back to scutellum; both sexes fully winged; antennae 6-segmented (both sexes). (Atlantic, Indian, and Pacific Coasts).
   Thalassomyia Schiner.
   (= *Galapagomyia* Johns.)
   Eyes hairy; tarsi shorter, fourth segment not markedly cordiform; second hind tarsal segment not longer than third; thorax without acrostichal hairs; wings reduced (at least in female). 6
6. Second hind tarsal segment subequal to third; fifth tarsal segment on all legs simple; wings strap-shaped (both sexes); palpi long, 3-6-segmented; antennae 6-segmented (male) or 4-segmented (female). (California).
   Eretmoptera Kellog.
   Second hind tarsal segment much shorter than third, fifth slightly bilobed; wings fully developed (male) or absent (female); palpi rudimentary; antennae 11-segmented (male) or 7-segmented (female). (North Atlantic and North-West Pacific Coasts). .. .. .. *Clunio* Haliday.

TELMATOGETON Schiner.

1866 *Telmatogeton* Schiner, Verh. b.g. Ges. Wien., 16,931.
1913 *Charadromyia* Terry, Proc. Haw. Ent. Soc., 2,292.
1920 *Trissoclunio* Kieffer, Ann. S. Afr. Mus., 17,523.
1928 *Telmatogeton* Edwards, Konowia, 7,234.
1931 *Telmatogeton* Edwards, Diptera of Patagonia and South Chile, Pt. 2, fasc. 5, 304; Brit. Mus.
1935 *Telmatogeton* Tokunaga, Philip, J. Sci., 57, 491.
1935 *Telmatogeton* Tokunaga, Chironomidae from Japan (5), Mushi, 8, 15.

The genus can be easily recognized by the complicated structure of the trilobed fifth tarsal segment, and by its fully developed wings in both sexes. Its nearest related genus is *Paraclunio* from North America. The genus is confined to the Southern Hemisphere.

TELMATOGETON AUSTRALICUS sp. nov.

Description of Adult: Length (both sexes) 3·0 mm., wing expanse 4·0 mm. Head light bluish-grey with dark stripes as figured. Scutellum and postscutellum dark brownish. Antennae dark, palpi darkish. Body lightish, with greyish mottling and laterally on each side with a pair of fine dark longitudinal stripes; hypopygium

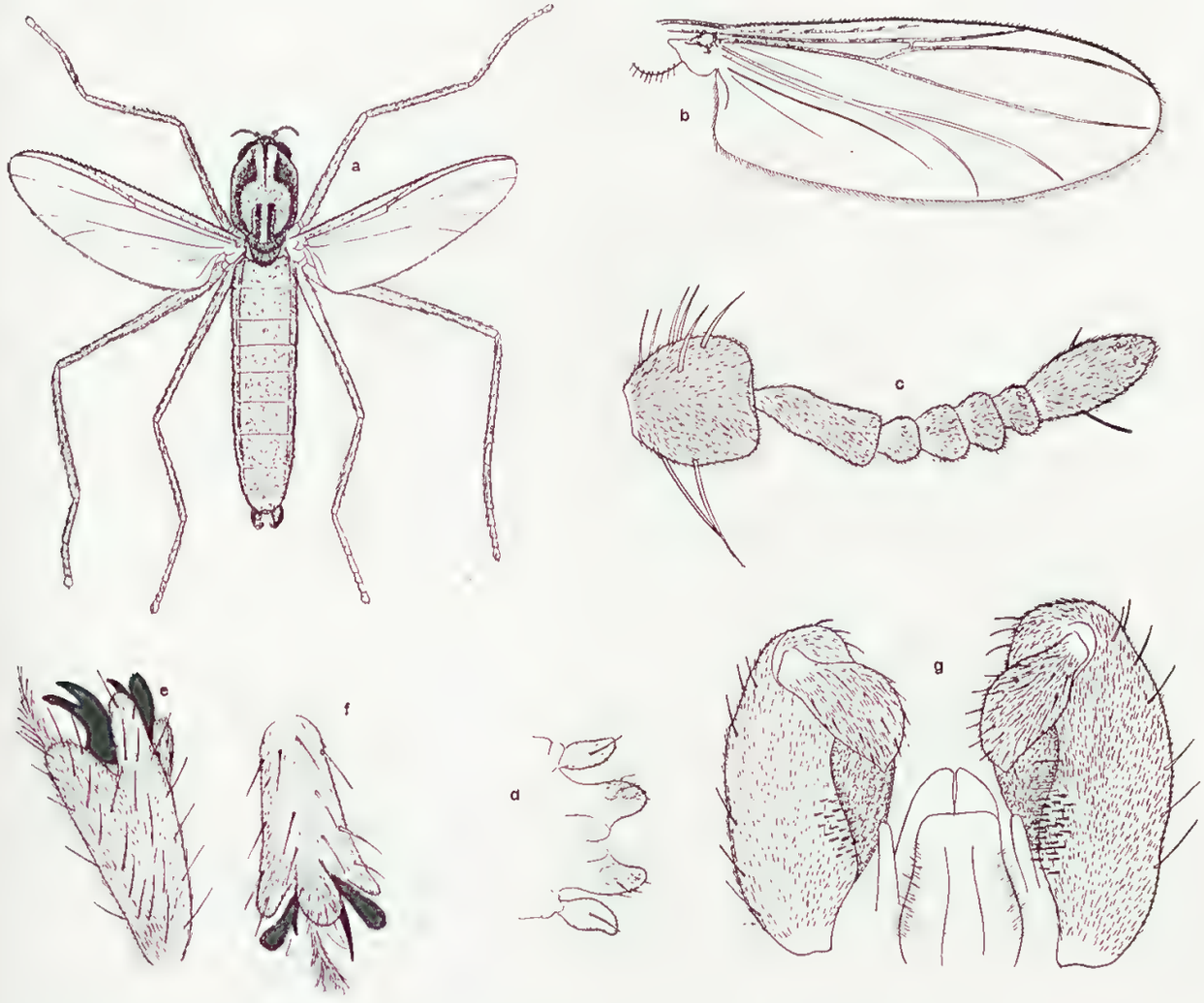

Fig. 1. Adult male: a, entire; b, wing; c, antenna; d, labium and labial palpi; e, fifth tarsal segment of middle leg from side; f, same from above; g, hypopygium.

dark brownish; wings in life pearly-grey opalescent; legs greyish-brown. Antennae 7-segmented, basal segment large, as broad as long, with about 8 setae; second segment slightly more than twice as long as wide at the tip, without setae; segments III-VI subglobose without setae; VII twice as long as wide, tapering towards tip without terminal process and with two setae; palpi two-segmented as figured. Eyes large, surrounded with fairly long numerous setae; mesonotum apparently without discernible setae; scutellum with two latero-anterior setae and four subposterior setae. Wings opalescent, venation and setae as figured; fork of Cu_1 — Cu_2 very slightly distad of r-m; macrotrichia on radius (R_1 and

R_{4+5}) not very numerous, about 20; subcosta with about 6 macrotrichia R_1 slightly less than half length of R_{4+5}; squamae fairly large, fringed; halteres yellow. Legs long and slender; femora on all legs somewhat thicker on basal two-thirds; all trochanters simple; fifth tarsal segment trilobed as in genus; claws with basal membraneous plates which are broad basally and taper to a sharp point, claws bifid almost to base; inner arm pointed, outer arm broadened, especially at apex, which has a fringed appearance (in this respect the species approaches *T. trochanteratum* from Chile), empodium long and long-haired; abdomen with sparse short hairs; hypopygium as figured.

Holotype male and *allotype* female and paratypes from Sellick's Beach, South Australia, April, 1936; other specimens from same locality February and March, 1936 (H.M.H.); also from Noarlunga, South Australia, April, 1936 (Miss J.C.).

Remarks: The species described in this paper is closely related to *T. trochanteratum* Edwards from Chile, and *T. minor* Kieffer from South Africa. It differs from both in the shape of the last antennal segment, and also in the lack of a protuberance on the middle trochanter in the male. The outer arms of the tarsal claws of the male are somewhat larger than in *T. minor*, according to the excellent figures and redescription of this species given by Hesse (Tr. Royal Entom. Soc., London, vol. 82, 27-40, 1934), while there also appears to be slight differences in the venation at the junction of r-m with R_{4+5}.

Description of Larva. Length of the two specimens found 4·0 and 5·0 mm. respectively. Colour in life probably whitish-green, only the head brown. General facies that of previously figured species of the genus. Head capsule non-retractile, longer than broad and highly chitinized, the surface sculptured with fine raised dots, but apparently without the numerous fine hairs of *T. japonicum* Tok., the unpaired dorsal sclerite between the anterior arms of the cephalic suture is oval, widest before the middle, but not as wide as in *T. japonicum*, furnished with a pair of lateral subanterior setae, lateral sclerites each with two setae and a medial pair of eyes, on each sclerite are four pores, one close to the anterior setae of the median sclerite, one just behind and lateral of the eyes, and two at the base and close to the median arm of the cephalic suture. The labrum is dorsally as figured with 3 pairs of setae. The antennae are 4-segmented, the first segment being stout and about half as long again as wide, the second similar but smaller, and the third and fourth very small and elongate. The mandibles are 5-toothed with 3 setae, while the labium has 5 teeth on each side besides the large broad median tooth. The labial palp is small, and as figured. The body is elongate, with few but very fine setae on each segment, the anterior pseudopods are furnished with a series of rows of gradually increasing simple curved hooks, the posterior pseudopods have a single

(apparently) circlet of strongly chitinized hooks which have an inner basal projection. The last body segment has two pairs of strong setae, each pair arising from a single base.

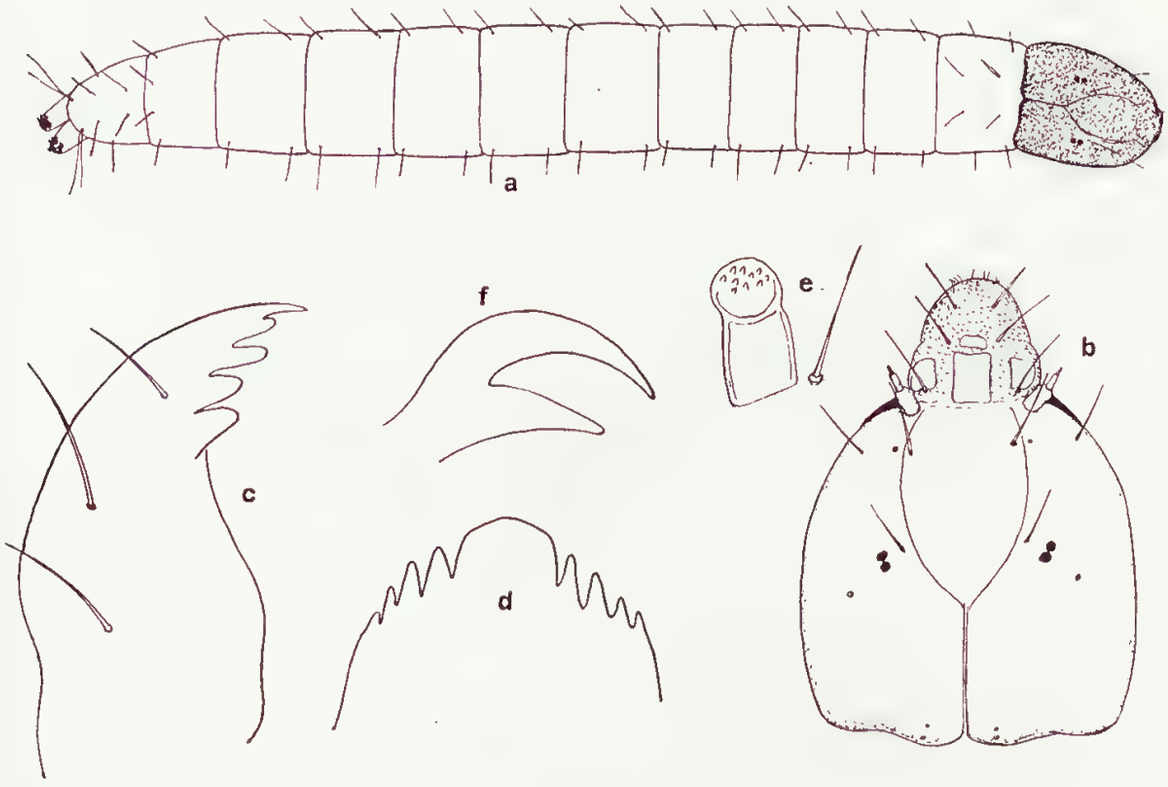

Fig. 2. Larva: a, entire dorsal view; b, head dorsal view; c, mandible; d, labium; e, labial palp; f, crochet of posterior pseudopods.

Locality. As for the adults, March 3, 1936.

Biological Notes. With the exception of the two Hawaiian species all members of this genus are truly marine forms living on reefs at low tide level. The Hawaiian species frequent torrents. To Mr. H. M. Hale I am indebted for the following observations on our local species:

"The two larvae were found floating on the surface film of rock pools at the extreme edge of the reef at low tide. The adults appear, often in thousands, on calm days with bright sunshine during the summer. Few, if any, emerge during cloudy days. They are seen only at low tide near the outer portions of the reef, which are covered at high water by about a fathom of water. They move rapidly with a hopping movement over the mossy rocks and about the small pools. In April examples were seen in copula at the edges of the rock pools, the tide being then dead low."

It is interesting to notice that while the Japanese species are, according to Tokanunga, noctural insects, our local one, as with the related European *Clunio marinus* Hal., is diurnal.

AMPHIPODS FROM A SOUTH AUSTRALIAN REEF

PART I.

By KEITH SHEARD, Hon. Assistant in Zoology, South Australian Museum.

Fig. 1–4.

INTRODUCTION.

The reef at Sellick's Beach is exceedingly rich in the smaller Crustacea, among which the Amphipoda are the most abundant in number and variety. The collection made by H. M. Hale (March to April, 1936) includes over two hundred separate forms, more than half of which are apparently not referable to known species. Yet from collections made for this Museum in Tasmania (N. B. Tindale), Queensland (J. T. Mortlock), and on Yorke Peninsula (H. Womersley, Dr. T. D. Campbell, and B. C. Cotton), all using the method described by H. M. Hale (Cumacea from a South Australian Reef, Rec. South Aust. Mus., 1936), it is apparent that this variety and number is not exceptional, and that careful collecting methods on most coastal reefs will provide a wealth of interesting, if hitherto neglected, material. The reef forms are in the main highly specialized for successful existence in their respective environments, and afford, when sufficient variety is studied, an excellent opportunity of separating ancestral stock characters from those resulting from habitus. A study of such forms should result in a better knowledge of the family relationships of the Order.

Family HAUSTORIIDAE.

Urohaustorius gen. nov.

Back broad, tapering to antennae and telson. Eyes invisible. First antennae arise from a small process barely covered by the short, pointed rostrum. Accessory flagellum subequal to flagellum. Second antenna with penultimate joint of peduncle greatly expanded; first, second, and third short and ring-like. Mandible with simple cutting edge and accessory plate, spine-row feeble, molar large, palp long. Second joint the longest; third club-shaped with setae. First maxilla with one jointed palp. Maxilliped, plates short and narrow, palp with second joint expanded, setose; fourth, finger-like. Gnathopods 1-2 as for *Hausto-*

rius arenius Slabber. Peraeopods 1-2 with dactyl spine-like. Peraeopod 3 with joints 2-5 expanded, heavily spined. Peraeopods 4-5, second joint widely expanded, remainder moderately expanded and armoured. Peraeopods 3-5 without dactyls. Pleopods well developed. Uropods heavily setose, biramous; uropod 3 with short, wide peduncle and widened rami, outer stouter and wider than inner, jointed near tip. Telson, short, broad, entire, margin with four spines. Sideplates: 1, short, pointed, curving forwards; 2, comparable, both hidden by the forward lobe of plate 3, which is the largest; broadly produced forward, the infero-distal edge narrowly produced backwards, and tipped with a long spine; 4, as long as, but narrower than 3, backward production comparable; 5, 6, 7, very small.

Uropods with setae, very finely plumose.

Genotype: *U. halei* sp. nov.

This genus represents a combination of the characters of *Haustorius, Urothoe* and *Phoxocephalopsis,* most noteworthy differences being spine-like dactyls on peraeopods 1 and 2; the shape and order of the sideplates; the entire telson, and the one-jointed palp of the first maxilla.

The two species here referred to *Urohaustorius* may be separated as follows:

a. Gnathopod 2, joints 2 and 5 subequal .. .. *halei*
aa. Gnathopod 2, joint 2 twice joint 5 .. .. *vercoi*

UROHAUSTORIUS HALEI sp. nov.

♀ Head short, broader than long, terminating in a small, sharply-pointed rostrum. Sideplates 1-2 small, acutely produced forwards, 3 the largest, longer than broad, covering sideplates 1-2 and the bases of gnathopods 1-2, and peraeopod 3, lower margin produced acutely backwards, terminating in a long spine; 4, large but smaller than 3, longer than broad, covering the base of peraeopod 4, narrowly produced backwards, and terminating in a long spine; 5-7 very small.

The third pleon segment is produced backwards, the process terminating in a spine. Pleon segment 4 the longest.

The body is free from setae or spines on its smooth surface.

Post antennal angles distinct, lateral corners moderate.

Eyes, not visible. Antenna 1: the pair are jointed to a small two-branched process arising from the frontal margin of the head. The junction of this process with the head is clearly visible. (See fig. 1 B.) First joint large, and tumid, as long as 2-3 together, and one and one-half times as broad as the second joint, which is setose, and more than twice as broad and slightly longer than the third; accessory flagellum 6-jointed, flagellum 8-jointed. Antenna 2: first joint small and ring-like, apparently soldered to the head; second free but short; third equal to 1 and 2 together, with the dorsal edge slightly produced and rounded; the fourth

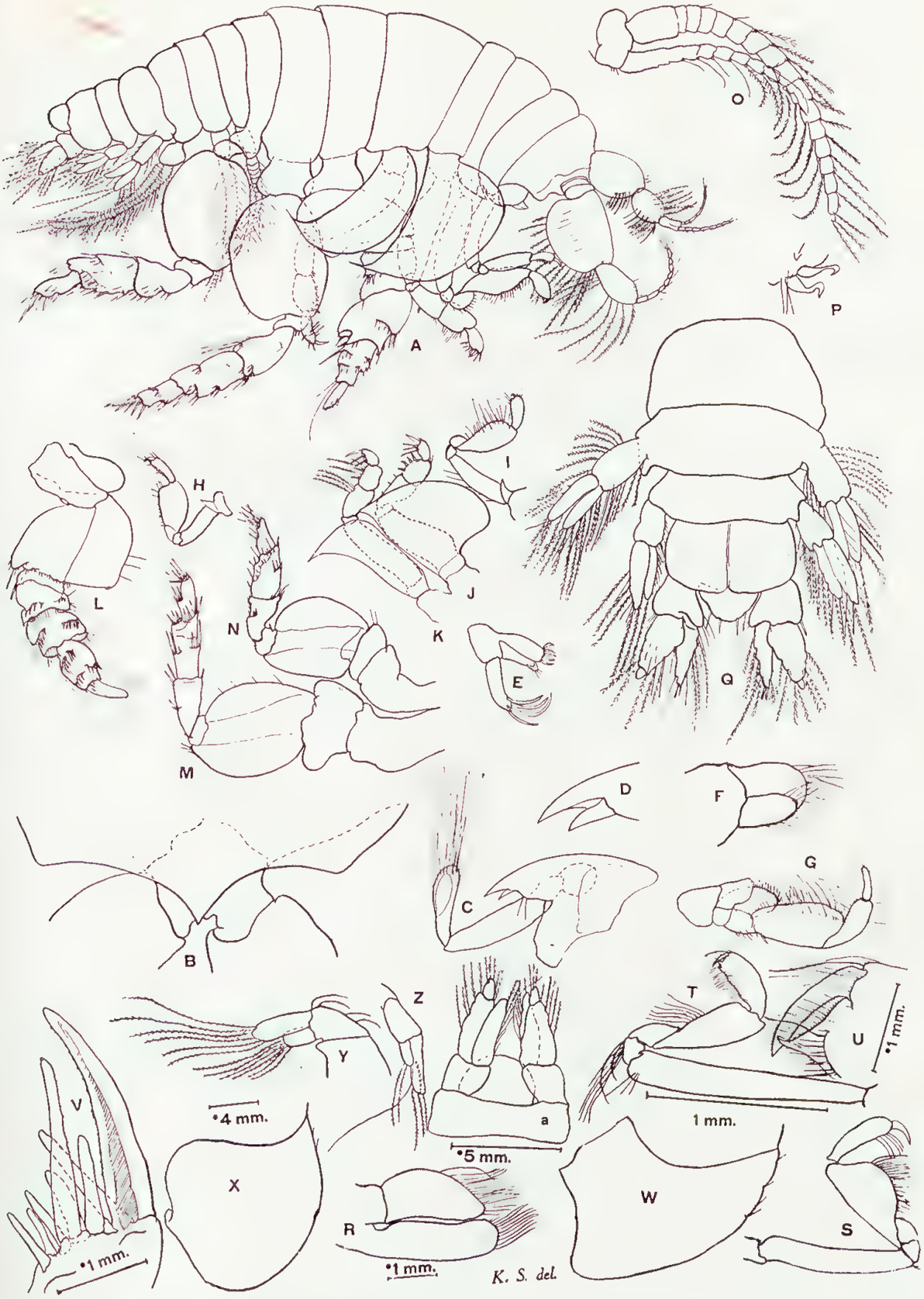

Fig. 1. A–Q, *Urohaustorius halei*, type male; A, lateral view; B, rostrum and antennal process; C, mandible; D, cutting edge of mandible; E, maxilla 1; F, maxilla 2; G, maxilliped; H, gnathopod 1; I, gnathopod 2; J–N, peraeopods 1–5; O, pleopod 3; P, coupling hooks Pl. 3; Q, uropods and telson. R–a, *Urohaustorius vercoi*; R, maxilla 2; S, gnathopod 1; T, gnathopod 2; U, gnathopod 2, chela; V, peraeopod 1, spines of joint 6 and dactyl; W, side-plate 3; X, side-plate 4; Y, uropod 1; Z, uropod 2; a, uropod 3 and telson.

joint is leaf-like, one and one-half times the length of the fifth, and varying from three times as broad in the male to twice as broad in the female, strongly setose, with plumose setae in both; the fifth joint is swollen, with long plumose setae; flagellum equal to length of fourth joint, 8-jointed; antenna not longer than head plus first four peraeon segments. Mandible: palp long, first joint short and stout, second nearly twice third, which is fringed on the underside of the distal half with plumose setae; molar strong, cutting edge simple, accessory cutting edge simple; spine-row feeble. Maxilla 1 with one jointed palp, terminating in four long spines. Maxilla 2 with the outer plate twice as broad and slightly longer than the inner. Maxillipeds: inner plate small, outer small; palp with second joint long and swollen, bearing long setae, third curved, fourth cylindrical, weak.

Gnathopod 1: second joint long and narrow, third very small, fourth small, produced inferiorly, fifth as long as second but nearly twice as broad, sixth cylindrical, weak; seventh curved, very weak. Gnathopod 2 comparable with first, but slightly larger; finger opposed by a spine, forming a small chela.

Peraeopod 1: side plate the largest; first joint distinct, twice as broad as long; second the longest; third ring-like, twice as broad as long; fourth half as long as second, and comparable in expansion; fifth subequal, spined on inferior margin; sixth half as broad and subequal in length; seventh spine-like. Peraeopod 2: slightly longer than first, with plumose hairs on the inferior margin of the fourth and fifth joints. Peraeopod 3: side plate little produced, weakly bilobed; distal lobe the larger, second joint expanded, articulated to third by a slight collar; third and fifth joints equally expanded, subequal; fifth less expanded, a little longer; sixth finger-like, equal in length to fourth; seventh not present; the whole appendage is relatively massive, the joints 3-5 studded with rows of spines. Peraeopod 4 the longest; side plate very small; second joint longer than broad; third ring-like, 4-6 cylindrical, heavily spined; seventh not present. Peraeopod 5 comparable to 4, fourth and fifth joints more produced distally.

Pleopods: stout, with plumose setae; third the longest, with its inner ramus more slender and about two-thirds as long as outer; two sickle-shaped coupling hooks on each peduncle, which is moderately expanded. Uropod 1 the longest; rami slightly shorter than peduncle, inner ramus slightly the shorter. Uropod 2 the smallest; rami subequal, longer than peduncle. Uropod 3 with rami and peduncle expanded, rami subequal; outer ramus longer and broader than inner, two-jointed, the joint comparable with those of the pleopod rami; is close to the distal end of the ramus. All uropods heavily setose with plumose setae. Telson one and one-half times as broad as long, semi-circular, undivided, with four marginal spines. Telson does not reach to end of peduncle of third uropod.

Length, type male, 2·5 mm.; ovigerous type female, 1·9 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef, burrowing in sand on sandy patches on reef; exceedingly common (H. M. Hale, Apl. 1936). Types in South Australian Museum, Reg. No. C. 2080, 2081.

This species, the most interesting Amphipod from the reef, has been named in recognition of the careful collecting work done there by Mr. H. M. Hale.

The male and female are little differentiated, although in the male the lateral lobes of the body segments are slightly more produced, and the body is flatter and slightly more leaf-like than in the female, which frequently assumes a more or less Sphaeromid-like shape. Immature males and females are much flatter than the mature forms, and the fourth pleon segment is not wider than the two adjoining in the specimens examined.

The species possesses long, stout, darkly-staining hairs on the antennae, pleopods, and uropods, sparsely scattered among the plumose setae. These stain blackly with magenta red, and the darkened interior appears to arise from well within the chiton. The whole has the appearance of a long hollow tube freely connected with interior of the appendage. The tubes are fringed with very fine setae, and appear to serve both sensory and aeration functions.

UROHAUSTORIUS VERCOI sp. nov.

This species is very close to *U. halei*, with the following as the chief differences:

Antenna 1, accessory flagellum with five joints, flagellum with seven. Side-plate 4 nearly as wide as long (*U. halei* at least three times as long as wide).

Gnathopod 1, joint 2, one and one-half times joint 5 (*U. halei* with these joints subequal).

Gnathopod 2, with joint 2 elongate, more than twice joint 5 (*U. halei*, joints 2 and 5 subequal).

Uropod 1, inner ramus one-half outer (*U. halei*, subequal).

Uropod 2, inner ramus less than one-half outer (*U. halei*, more than half).

Length, 5 mm.

Loc. Western Australia: Geographe Bay (J. C. Verco).

In the type female the dactyls of peraeopods 1-2 are unmistakable (fig. 1, V), while the antennal process is clearly marked off from the head.

The species is named after its collector, Dr. J. C. Verco, and is interesting as illustrating the wide range of the genus. In the same dredging was taken a species of *Haustorius* with the pleon segments very reduced, the telson cleft to the base, antennae little expanded, and with side-plates approaching those of *Urohaustorius*. This will be described later.

REFERENCES.

Della Valle (1893) : *F. Fl. Neapel,* xx. pl. lx, fig. 22-23.
Holmes, S. J. (1905) : *Bull. U.S. Bureau Fish,* xxiv, pl. v.
Stebbing (1906) : *Das Tierreich,* Lf. xxi, pp. 118-148.
Barnard (1932) : *Discovery Reports,* v, p. 94.

SIPHONOECETES SELLICKI sp. nov.

The points of difference from *S. australis* Stebbing(1) are as follows:

Rostrum: Definitely pointed, projecting beyond eye-lobes.

First Antenna: Five-jointed flagellum, the fifth joint minute.

Second Antenna: Fifth joint of peduncle the longest.

Head: Equal to longest peraeon segment (fifth).

Side-plates: All are shallow, first and second acutely produced forwards, the remainder softly rounded.

Pleopods: Inner ramus two-thirds outer (*S. australis* sub-equal). Both rami are jointed very close to the proximal edge of the peduncle, and their roots are slender.

Uropods: First, outer ramus equals two-thirds peduncle, which is not spined. Second, outer ramus shorter than peduncle. The inner is small, and its base is partly overlapped by the peduncle, which is produced on its inner side to a rounded lobe (fig. 2 N), fringed with very short spines. The third uropod is vestigial, the outer ramus very short, is fringed with five long hairs. The peduncle is prolonged on its inner side, and studded with five spines. In the ventral view (fig. 2 N) it has the appearance of being open at the tip, forming a suction-plate. However, it is difficult to clearly define the detail at the magnification employed.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef (H. M. Hale, 1936). Types in South Australian Museum, Reg. No. C. 2114, 2117.

This Amphipod lives in short, hollow pieces of *Cymodocea* stem (2) loosely lined with silky material. The specimens described were collected in January, 1936, by Mr. H. M. Hale, when he noticed fragments of *Cymodocea* stem moving independently of the currents in a small rock pool at Sellick's Reef, at low tide. Eight stalks containing ovigerous females were found. Repeated searching since that date has only disclosed one more specimen. No males were discovered. The females of length 4 mm. contain 10-11-12 eggs arranged in echelon, the whole amphipod completely filling the tubal space.

(1) Stebbing, Mem. Aust. Mus., iv, 1910, p. 619, pl. lvi.

(2) Hale, Trans. Roy. Soc., S. Austr., xlviii, 1924, p. 225, and Crust. S. Aust. (Brit Sci. Guild Handbook), 1929, p. 322.

S. sellicki bears its antennae in a characteristic cruciform manner; they are orange, spotted with black; the body is slatey-grey to the fifth peraeon segment, the remainder pallid. Infolding and rapid diminution in size commences with the fourth pleon segment, segments 5 and 6 being considerably reduced; the telson is as long as the fourth pleon segment.

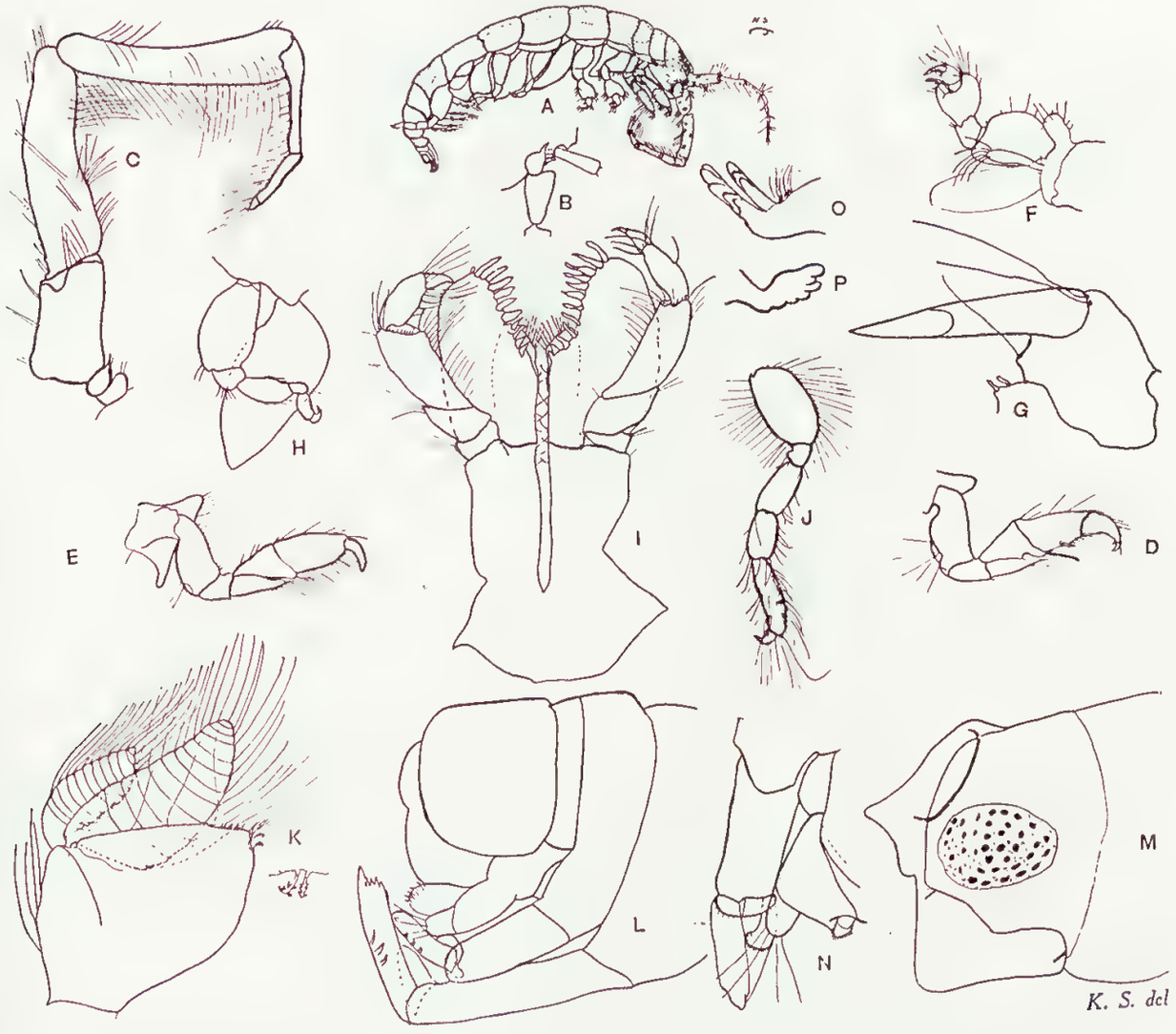

Fig. 2. *Siphonoecetes sellicki*: A, lateral view of female; B, eye-lobe; C, second antenna; D, first gnathopod; E, second gnathopod; F, second peraeopod; G, finger of F; H, fourth peraeopod; J, fifth peraeopod; I, maxilliped; K, third pleopod; L, telson and uropods; M, head; N, second and third uropod; O, cutting edge of right mandible; P, cutting edge of left mandible.

The proportions of the peraeon appendages of the type specimen agree fairly closely with those for *Siphonoecetes australis*, but the individual specimens vary slightly, as might be expected from the nature of their environment.

In general, the species bears stouter appendages than *S. australis*, and its appearance is slightly more robust; in all specimens high magnification and appropriate staining are necessary to detect the sutures of the sixth segment. Without

dissection it may be separated from *S. australis* by the following characteristics: the third joint of peraeopod 2 is cylindrical, as broad as long; the fifth joint of peraeopod 4 is twice as long as broad (*S. australis* one and one-half times as broad as long), and the small rostrum is sharply pointed (*S. australis* bluntly rounded). The species is very close to *S. smithianus* Rathbun.

FAMILY OEDICEROTIDAE.

EXOEDICEROS Stebbing.

EXOEDICEROS MACULOSUS sp. nov.

♀ Eyes moderately large, oval, with the surface rounded. Antenna 1, joints of peduncle successively shorter and more slender; first joint as long as second and third together; flagellum of about 30 joints, each carrying a small calceoli which gives the flagellum a saw-like appearance; accessory flagellum, a single rudimentary joint, tipped with long setae. Antenna 2, first two joints of peduncle short and stout, appearing to fuse with the head; third is free and about one-half the width of the first; fourth is stouter than fifth and slightly longer, equal to twice third; flagellum as for antenna 1, but with about 40 joints; antenna 2 about one and one-third as long as antenna 1, and proportionately stouter. Mandible, well developed, palp large, first joint short, second three times, and third two and one-half times as long; molar, cutting edges and spine-row well developed; gnathopod 2 larger than 1, but of similar form; fifth joint widened and setose, produced to palm of oval sixth. Peraeopods 1 and 2 possess no finger, and have the fourth joint widened; fifth and sixth not widened, sub-equal. Peraeopods 3 and 4 have fourth and fifth joints only slightly widened. Peraeopod 5, first joint with very small plate, second joint quadrate, hind margin nearly straight; length of peraeopod 5 equals twice peraeopod 2.

Pleopods with side-plates of pleon segments 1-3 progressively larger, postero-lateral angles rounded; each of the plates of the pleon bears an inner row of double spines close to the inferior margin, and a large chromatophor at about the centre of the plate; these characteristic chromatophors are also present on the uropod segment and telson.

Uropod 1 bears stout spines on the sub-equal rami, inner ramus equal to peduncle. Uropod 1 is nearly twice as long as peduncle plus outer ramus of uropod 2, and one and one-half times as long as uropod 3. Uropod 2 the smaller and more slender; inner ramus slightly shorter than peduncle, outer slightly longer, both slightly spined.

Uropod 3 stout, with peduncle and outer ramus spined, inner ramus lanceolate, with long setae; rami equal, and equal to peduncle in length. Telson, small entire, quadrate, equal in length to second uropod segment; normally carried upturned.

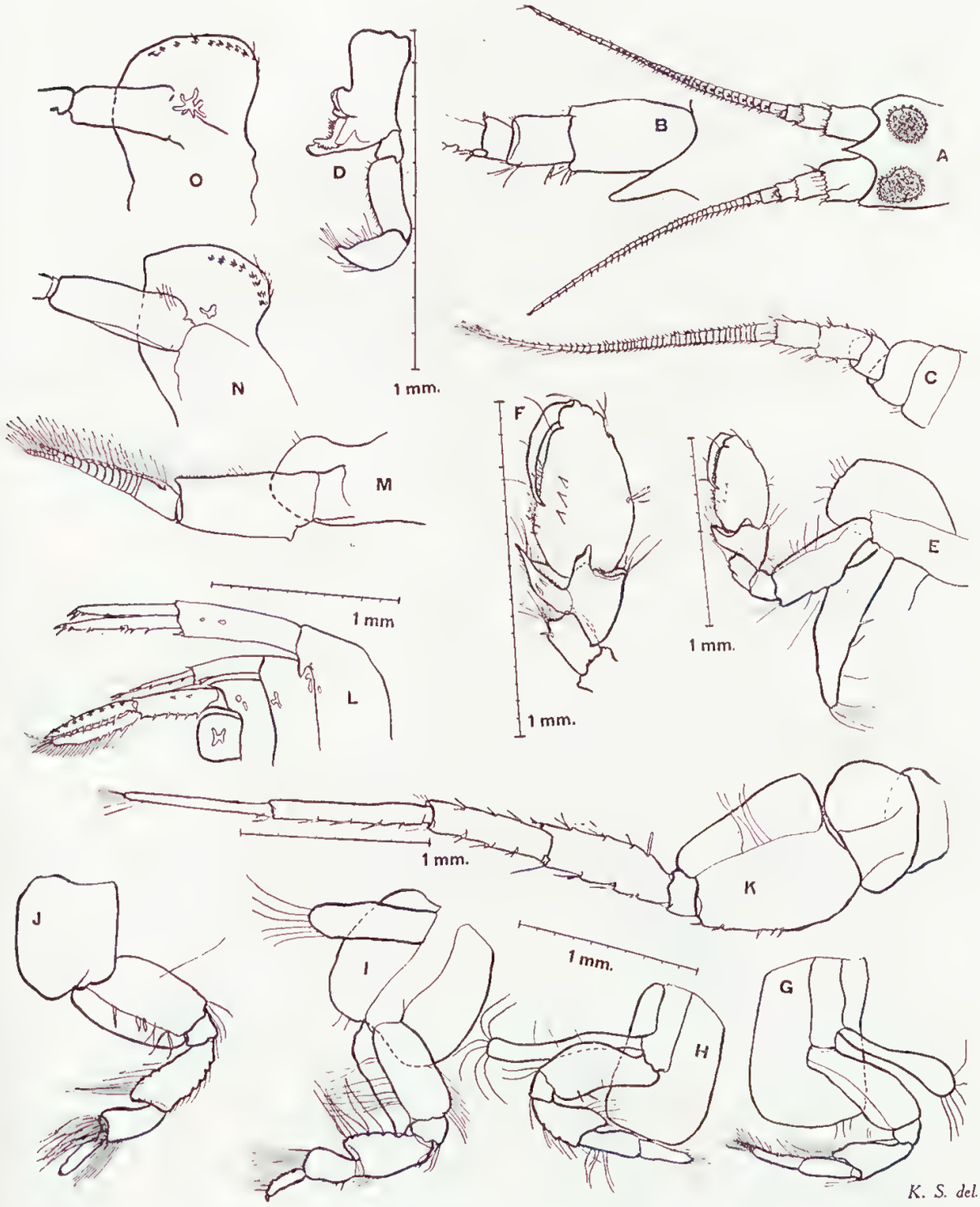

Fig. 3. *Exocdiceros maculosus*, type female; A, antennae 1 and rostrum; B, peduncle of antenna 1; C, antenna 2; D, mandible; E, gnathopod 2; F, palm of E; G–K, peracopods 1–5; L, uropods and telson; M, pleopod 1; N–O, peduncles and side-plates of pleopods 2–3.

Length, 3 mm.

Loc. South Australia: Gulf St. Vincent, Sellick's Reef; common in sandy pools left at low tide (H. M. Hale, Apl. 1936). Types in South Australian Museum, Reg. No. C. 2084, 2085, 2086.

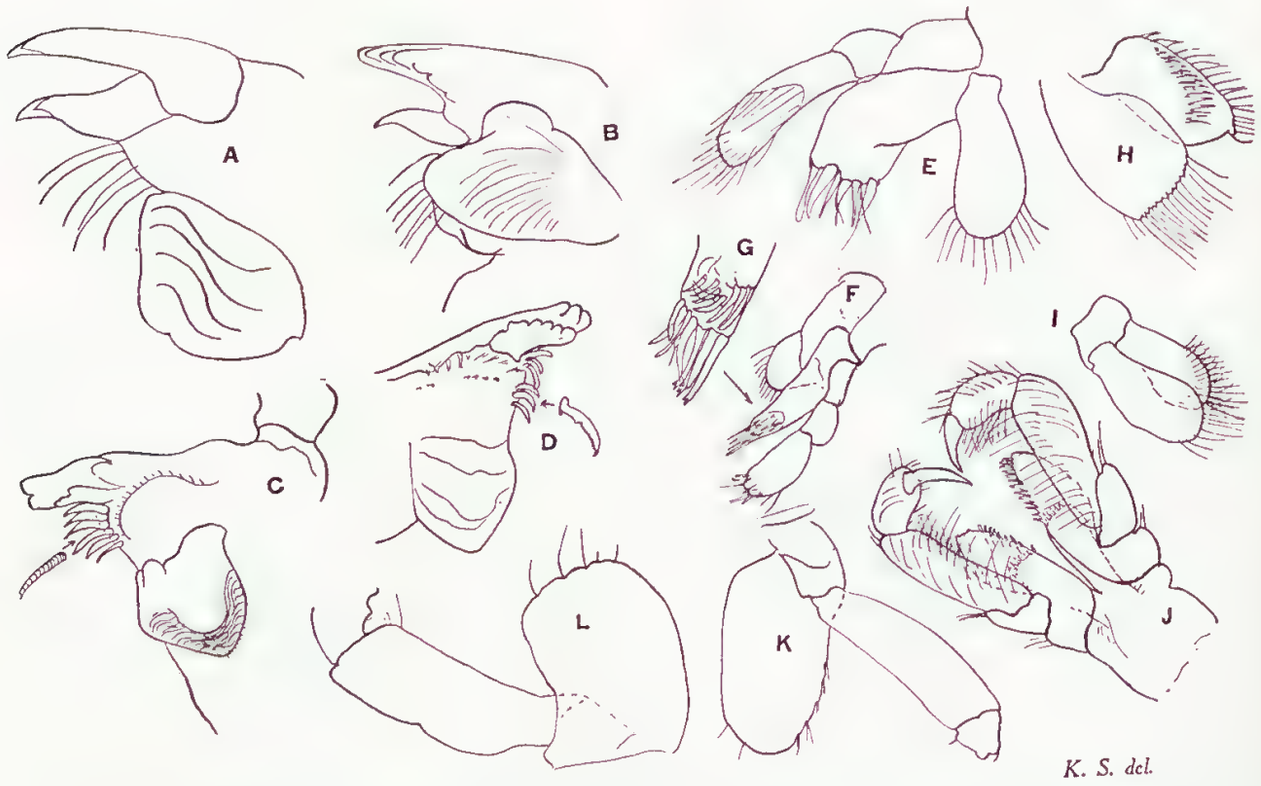

Fig. 4. Mandibles of *Exoediceros fossor* (A–B) and *E. maculosus* (C–D); maxilla 1 of *E. fossor* (E) and *E. maculosus* (F–G); maxilla 2 of *E. fossor* (H) and *E. maculosus* (I); maxilliped of *E. maculosus* (J); side-plate and gnathopod 1 of *E. fossor* (K) and *E. maculosus* (L).

Through the courtesy of the Australian Museum authorities I have been able to examine specimens of *Exoediceros fossor* (*Oedicerus arenicola* Haswell). (See fig. 2.) The main differences between this species and *E. maculosus* are as follows:

Size (mature females): *E. fossor*, length, 7 mm.; greatest width of peraeon, 3 mm. *E. maculosus*, length, 5 mm.; greatest width of peraeon, 1·5 mm. Rostrum: *E. fossor*, short, and not reaching beyond middle of first joint of peduncle of first antenna. *E. maculosus*, relatively longer, reaching beyond middle of first joint of peduncle of first antenna (this characteristic is constant for immature, sub-adult and adult specimens examined of both sexes).

Colouration (spirit specimens): *E. fossor*, no trace of chromatophores. *E. maculosus*, bright red chromatophores as described.

Mandible: *E. fossor*, spine-row weak; accessory cutting edge pointed and

simple. *E. maculosus,* spine-row with strong spines; accessory cutting edge small and dentate.

Maxilla 1: *E. fossor,* inner plate large. *E. maculosus,* inner plate small.

Maxilla 2: *E. fossor,* plates wide. *E. maculosus,* plates comparatively narrow.

Side-plate 1: *E. fossor,* five sets of spines on inferior edge; two spines on distal edge; narrow. *E. maculosus,* five spines on distal edge; comparatively wide.

Embryos still within the egg-case were possessed of fully-developed fifth peraeopods.

In washings from the wave-beaten beach (Hale, Sept. 1936), *Urohaustorius halei* and *Exoediceros maculosus* were abundant.

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Haswell (1879): *Proc. Linn. Soc., N.S. Wales,* iv, p. 325, pl. xxiv, 3.

Stebbing (1906): *Das Tierreich,* xxi, p. 239.

Pirlot (1932): *Siboga-Expeditie,* Livr. cxvii, Mon. xxxiii, b, p. 106.

AMPHIPODS OF THE PHLIANTID GROUP IN THE SOUTH AUSTRALIAN MUSEUM, WITH A SUGGESTED DIVISION OF THE FAMILY

By KEITH SHEARD, Honorary Assistant in Zoology, South Australian Museum.

Fig. 1-6.

The examination of five new species of the family Phliantidae provides an opportunity for a brief revision of the family, which falls into two divisions:

a. Genera with first maxillae incomplete, telson entire.
aa. Genera with first maxillae complete, telson cleft.

1899 *Phliadidae* Stebbing, Tr. Linn. Soc. Lond., ser. 2, Zool. vol. 7, p. 414.
1906 *Phliadidae* Chevreux, Bull. Soc. Zool. Fr., vol. 31, p. 87.
1906 *Phliantidae* Stebbing, Das Tierreich, 21, pp. 200, 726.
1909 *Phliantidae* Chilton, Tr. N. Zeal. Inst., vol. 41, p. 61.
1910 *Phliantidae* Kunkel, Tr. Conn. Ac. Sci., vol. 16, p. 19.
1910 *Phliasidae* Chevreux, Mem. Soc. Zool. Fr., vol. 23, p. 201.
1916 *Phliantidae* Barnard, Ann. Sth. Afr. Mus., vol. 15, pt. 3, p. 155.
1927 *Phliantidae* Reibisch, Handbuch der Zoologie. Kukenthal, iii band, i halfte, p. 799.
1932 *Phliantidae* Pirlot, Siboga-Expeditie, M. xxxiiib, Livr. cxvii, p. 105.

In order to accommodate the very diverse genera and yet give a framework strict enough for valid identification, the characteristics of the family have been extended, and two subfamilies have been erected, although the claims of *Bircenna*, *Eophliantis* (gen. nov.), and possibly *Kuria* Walker to inclusion in a separate family are strong.

Family PHLIANTIDAE.

Peraeon strongly developed. Pleon segments 5-6 subject to degradation. Antennae 1-2 short, antenna 1 without accessory flagellum, flagellum with sensory filaments. Upper lip with distal margin usually undivided. Lower lips without inner lobes. Mandible without palp. Maxilla 1 variable. Maxillipeds with palp joints variable.

Gnathopods 1-2 simple or feebly chelate. Peduncle laterally produced in one or more pleopods. Uropod 3 usually not biramous. Telson entire or cleft.

With two subfamilies:

a. Telson cleft .. .. *Eophliantinae*
aa. Telson entire .. .. *Phliantinae*

a. EOPHLIANTINAE, Subfamily nov.

Peraeon strongly developed. Pleon segments 5-6 very small. Antennae 1-2 short and slender, antenna 1 without accessory flagellum. Upper lip not divided. Mandible without palp, molar variable. Maxilla 1 with inner plate and one jointed palp (? *Kuria*). Maxillipeds, inner plate reaching to outer; palp four-jointed. Gnathopods 1-2 simple or feebly chelate. Pleopods biramous, peduncles expanded. Uropods 1-2 biramous. Uropod 3 variable, very small. Telson cleft to base, upturned.

With three genera and five species:

a. Uropod 3 biramous .. .. *Eophliantis*
aa. Uropod 3 not biramous.
b. Side-plates shallow .. .. *Bircenna*
bb. Side-plates deeper than segment .. .. *Kuria*

EOPHLIANTIS gen. nov.

Peraeon strongly developed (sub-cylindrical). Head almost spherical. Eyes small. Side-plates shallow. Antennae 1-2 short and slender. Molar present on right mandible. Maxilla 1 with outer and inner plate and one jointed palp. Peraeopods 3-5 with second joint widely expanded. Peraeopod 5 the longest. Pleopod 1 peduncle slightly expanded; pleopods 2-3 with peduncles widely expanded; all biramous. Uropods 1-3 biramous, uropod 3 very small but with joints clearly marked. Telson small, cleft to base, upturned.

Genotype: *E. tindalei* sp. nov.

EOPHLIANTIS TINDALEI sp. nov.

♀ All segments to the third pleon segment very loosely articulated. Head with distinct neck. Antenna 1, ultimate joint of peduncle the longest; flagellum five-jointed with sparse setae. Antenna 2, shorter, division of peduncle and flagellum not marked; total seven-jointed. Right mandible with weak molar and feeble spine-row. Left, clear, with cutting edge produced. Maxilla 1, outer plate bearing six, toothed spines, inner with six(?); palp one-jointed with a single apical seta. Maxilla 2 with short base and long subequal plates, outer with eight, inner

with six slender spines. Maxilliped as in *B. fulva* Chilton. Gnathopod 1 long and slender, with a secondary unguis and accessory spine on the seventh joint. Gnathopod 2 long and very slender, otherwise comparable. For peraeopods, see fig. 2, I-K.

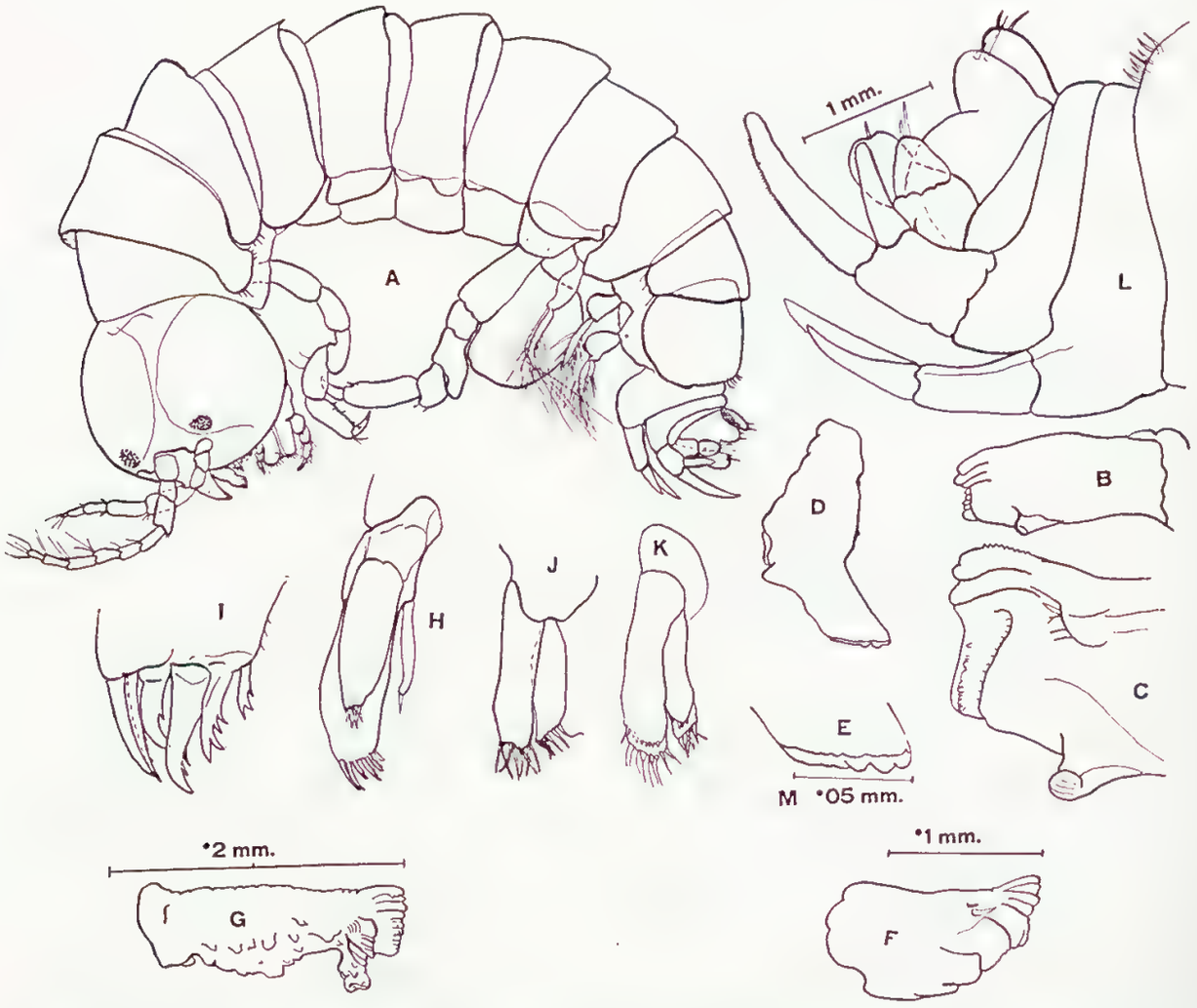

Fig. 1. A–L, *Eophliantis tindalei*, male; A, lateral view of type male; B–C, right mandible; D–E, left mandible; F, mandible, immature; G, mandible, paratype male; H, maxilla 1; I, spines of outer plate; J, maxilla 2; K, maxilla 2 of form with mandible G; L, uropods and telson; M, comparative scale for B, C, D, E, H.

Pleopods 2-3 with broadly expanded peduncle twice as wide as long, rami moderately setose.

Two sets of three spines each occur on the right and left postero-dorsal edges of the third pleon segment. Segments 4-6 small but distinct. Uropod 1, outer ramus equal to peduncle, inner one and one-third times longer; inferior margins of rami lined with fine spines. Inner ramus equal in length to inner ramus plus peduncle of second uropod. Uropod 2 three-quarters as long as uropod 1, with inner ramus equal to peduncle, outer one and one-half times inner, margins smooth. Uropod 3

slightly shorter than peduncle of uropod 2, rami rounded, equal to peduncle, outer ramus with one, inner with two apical spines.

Telson short, triangular, upturned, completely cleft into two triangular nearly opposed facies, each tipped with two spines.

Fig. 2. *Eophliantis tindalei*, female; A, antenna 1; B, antenna 2; C–D, gnathopods 1–2; E, gnathopod 2, seventh joint, paratype; F, gnathopod 2, seventh joint, type; H–L, peraeopods 1–5; M–N, pleopods 2–3; O, uropods and telson.

Colour, pale yellow.

Length, 4 mm.

Loc. Tasmania: Pt. Wynyard, in fine sand and algae, on tidal rocks, periodically flooded with river water. (N. B. Tindale, Apl. 1936). Types in South Australian Museum, Reg. No. C. 2072, 2073.

The type male from the same locality differs from the female in the following particulars:

Antenna 1, flagellum six-jointed. Antenna 2, total eight-jointed.

Gnathopods 1-2 with the infero-distal angle of the sixth joint slightly more produced. Infero-lateral edge of peraeon segment 1 slightly more produced with three spines on each of the antero and postero-lateral angles. Infero-lateral edge of peraeon segment 2 bears three spines centrally. Two sets of six moderately stout spines are present on the postero-dorsal edge of the third pleon segment.

Uropod 1 with inner ramus only slightly longer than peduncle of uropod 2. Uropod 2 longer than uropod 1, with inner ramus equal to peduncle, outer nearly twice inner, with inferior margin armoured with very short spines. Uropod 3 longer than peduncle of uropod 3. The sex differences are very slight. The individual variations in the mandibles and sixth joints of the gnathopods are of interest.

Females have been noted carrying from three to eleven developing ova in the brood-pouch. One male was peculiar in possessing an accessory row of small spines on the plates of the second maxillae (fig. 1, K). The difference in the manner of carrying the uropod segments in this subfamily as typified by *E. tindalei* compared with that of the subfamily *Phliantinae* is striking.

BIRCENNA Chilton.

Body broad. Head not rostrate. Antennae short, subequal, both pairs very slender; second with prominent gland cone. Mandibles without palp, molar wanting or weak. Maxilla 1 with inner and outer plates and one jointed palp. Maxillipeds with outer plate not extending beyond inner, palp four-jointed, fourth joint small, not unguiform. First and second gnathopods with the hinder apex of the sixth joint a little produced. Pleopods all biramous, and with the peduncles broadly produced laterally. Uropods 1-2 with unequal, curved rami. Uropod 3 rudimentary. Telson cleft to base, each half triangular and more or less opposed.

With three species:

a. Molar wanting.
  b. Uropods 1-2 with rami nearly twice peduncle .. .. .. *fulva*
  bb. Uropods 1-2 with rami nearly equal peduncle .. .. .. *crassipes*
aa. Weak molar present both mandibles . .. . *nichollsi*

BIRCENNA FULVA Chilton.

One of the syntypes was kindly lent for examination by the Director of the Canterbury Museum, and is here figured in detail. The three-membered first maxilla is to be noted (fig. 3, E, F, G). There are three spines on the postero-dorsal margins of the third pleon segment.

BIRCENNA NICHOLLSI sp. nov.

♀ Peraeon much larger than pleon. Head not rostrate, but slightly bulging forwards over antennae. Eyes very small. Antennae very slender and short. Second with small calceolus on distal edge of fifth joint of peduncle. Flagellum

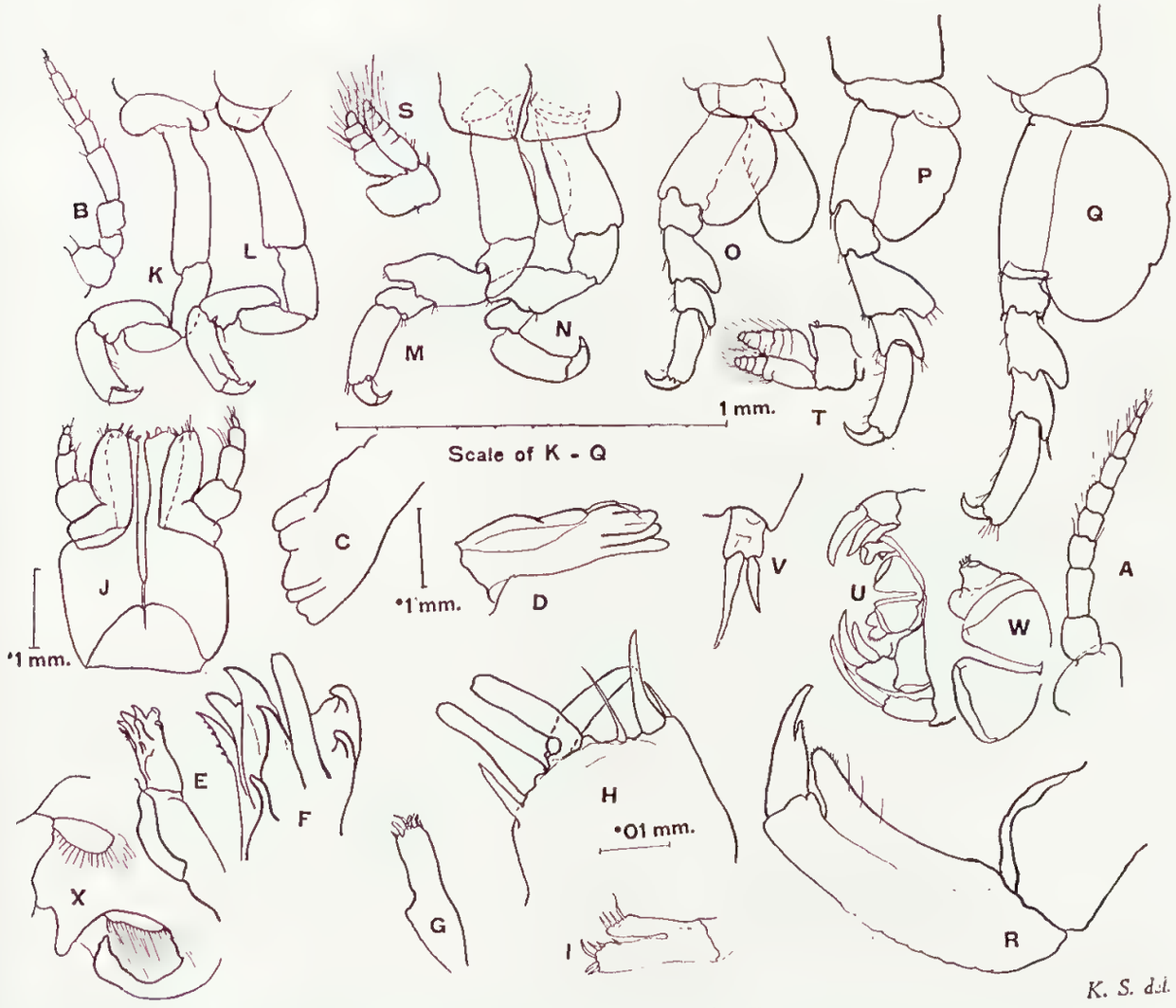

Fig. 3. A–X, *Bircenna fulva*, female; A, antenna 1; B, antenna 2; C–D, mandibles; E, maxilla 1, outer plate and palp; F, tip of outer plate; G, inner plate; H, tip of inner plate; I, maxilla 2; J, maxillipeds; K–L, gnathopods 1–2; M–Q, peraeopods 1–5; R, gnathopod 2, terminal joints, cotype; S–T, pleopods 2–3; U, uropods and telson; V, uropod 1; W, telson and uropod 3; X, setiferous lobes of lower lip.

two-jointed. Mandible with weak molar, cutting edge produced. Maxilla 1 with outer plate bearing six finely-toothed spines, inner with five simple spines, one jointed palp with one apical seta. Maxilla 2 with very short base and long, subequal, flattened plates. Maxillipeds very small, with third joint of short palp the longest, fourth joint more swollen than in *B. fulva*. Gnathopods 1-2 like *B. fulva*, but production of infero-distal edge of sixth joint not as acute, and with gnatho-

pod 1 slightly longer than gnathopod 2. Peraeopod 5 is slightly shorter than peraeopod 4. Pleopods 1-3 with peduncles more than twice as broad as long (*B. fulva* less than twice as broad as long).

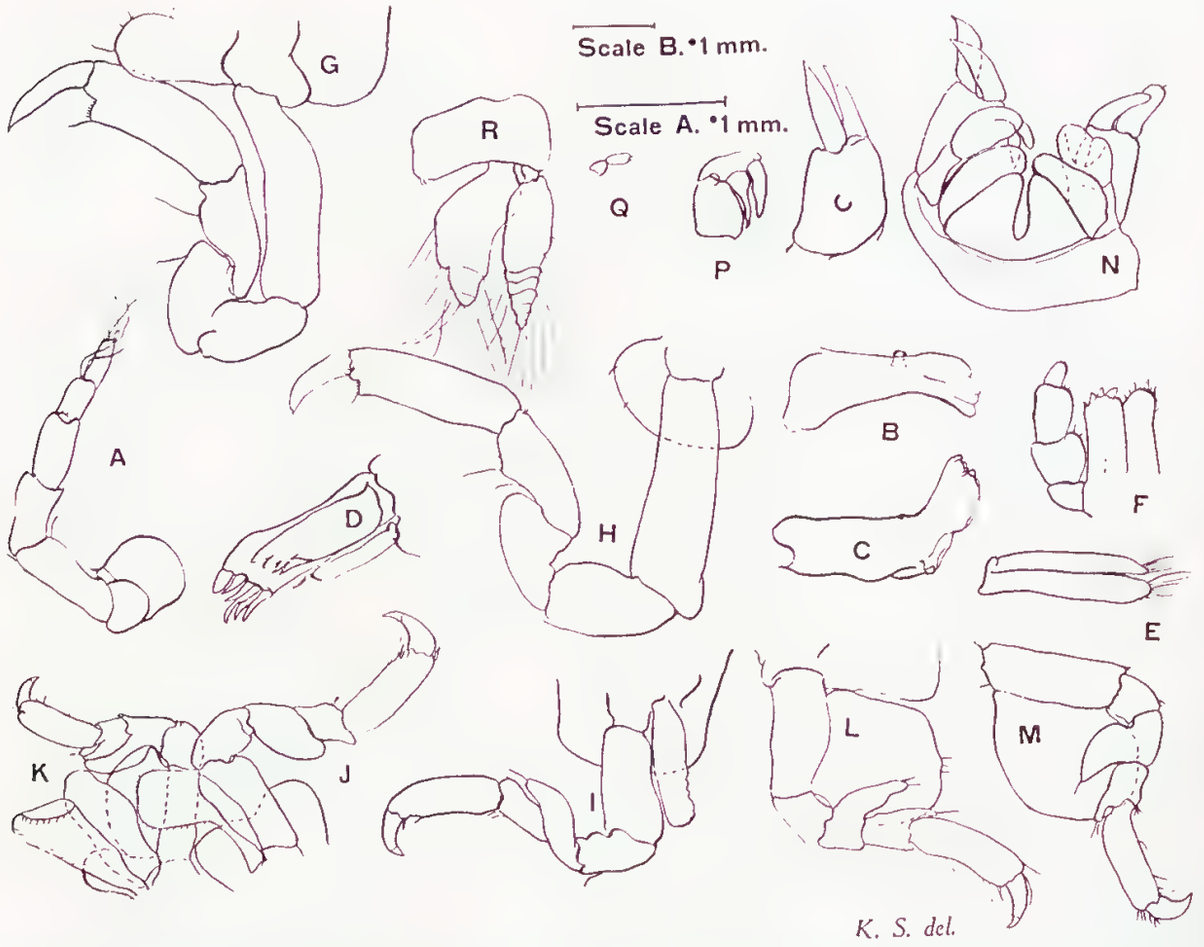

Fig. 4. A–R, *Bircenna nichollsi*; A, antenna 2; B–C, mandibles; D, maxilla 1; E, maxilla 2; F, portion of maxilliped; G–H, gnathopods 1–2; I–M, peraeopods 1–5; N, uropods 1–2 and telson; O, uropod 1; P, uropod 2; Q, uropod 3; R, pleopod 3.

Uropod 1 with rami subequal, slightly shorter than peduncle, with a small hooked spine on each ramus near the apex. Uropod 2, rami subequal, inner slightly longer, equal to peduncle; the whole appears to form a hooked structure. Uropod 3 extremely small, apparently consisting of a peduncle and single ramus, tipped with two setae, hidden by the short triangular, cleft telson.

Size, 2 mm.

Loc. South Australia: St. Vincent's Gulf, Sellick's Beach, among algae growing on the film of sand covering rocks below low-tide mark (H. M. Hale, 1936). Type in South Australian Museum, Reg. No. C. 2074.

The ovigerous female with two developing eggs was the only specimen collected. It has been named in honour of Professor G. E. Nicholls, of the University of

Western Australia, who has worked on a number of Australian and Antarctic Amphipods.

In general it resembled *B. fulva* fairly closely, but is remarkable for the shortness and slenderness of the gnathopods and peraeopods, the longest being only very slightly longer than the depth of the body; *B. fulva*, at least twice as long as the greatest body depth.

KURIA Walker.

1903 Nat. Hist. Sokotra and Abd-El-Kuri, Liverpool Mus. p. 228.

It is evident that this genus is closer to *Bircenna* than to the typical *Phliantinae*, but it is desirable that the first maxillae be re-examined. In this revision it has been placed, tentatively, with the *Eophliantinae*.

It is difficult to accept Stebbing's positive identification of *Biancolina algicola* Della Valle with *B. cuniculus* (*Ampithoe cuniculus* Stebbing). It may be of advantage to re-examine the types of the first-named with special reference to the mouth parts and telson.

aa. PHLIANTINAE Subfamily nov.

Peraeon strongly developed. Pleon segments 5-6 subject to degradation. Antennae 1-2 very short. Antenna 1 with joints of peduncle generally expanded, no accessory flagellum, flagellum with sensory filaments. Upper lip with distal margin usually undivided. Lower lip without inner lobes. Mandible without palp. Maxilla 1 incomplete; maxilliped with palp variable. Gnathopods 1-2 simple or weakly chelate. Peduncle laterally expanded in one or more pleopods. Pleopod 3, inner ramus subject to degradation. Uropod 3 usually not biramous. Telson short, entire, not upturned. With 8 genera, 10 species.

Synopsis of genera:

a. Maxillipeds, palp two-jointed .. .. *Temnophlias*
aa. Maxillipeds, palp more than two-jointed.
  b. Maxillipeds, palp three-jointed.
    c. Uropod 3 biramous .. .. *Phlias*
    cc. Uropod 3 not biramous.
      d. Uropod 3, peduncle and ramus distinct .. *Percionotus*
      dd. Uropod 3, peduncle not distinct from ramus *Palinnotus*
  bb. Maxilliped, palp four-jointed.
    e. Pleopod 3, inner ramus well developed . *Iphinotus*
    ee. Pleopod 3, inner ramus rudimentary.
      f. Uropod 3, peduncle distinct from ramus .. .. *Quasimodia* gen. nov.
      ff. Uropod 3, peduncle not distinct from ramus.
        h. Maxilla 1 with palp .. .. *Plioplateia*
        hh. Maxilla 1 without palp .. .. *Iphiplateia*

QUASIMODIA gen. nov.

Body depressed, pleon strongly flexed. Segments of body tuberculate in medio-dorsal line. Peraeon segment 1, medio-dorsal area produced, cowl-like, over the head. Mouth parts as for Iphiplateia. Gnathopods 1-2 simple. Pleopod 3, inner ramus vestigeal and non-setose or rudimentary and setose. Uropods 1-2 biramous. Uropod 3 consisting of peduncle and ramus, inner ramus sometimes present in modified form. Telson short, entire.

With three species:

a. Pleopod 3, inner ramus vestigeal, non-setose .. .. .. *Q. womersleyi*
aa. Pleopod 3, inner ramus rudimentary, setose.
b. Uropod 3, ramus twice as long as peduncle .. .. *Q. capricornis*
bb. Uropod 3, ramus equal to peduncle .. .. *Q. barnardi*

Ovigerous females of the species described were associated with specimens of the same size, but lacking marsupial plates, and with a slightly greater development of sensory setae. These I assume to be males. Although the generic and specific characteristics keyed are of small and relatively inaccessible parts, they can be readily distinguished by the application of the following method (after Womersley and Hale):

1. Clear in synthetic oil of wintergreen, 1-2 hours.
2. Pass through acetic acid.
3. Mount in gum chloral.

Should a more detailed examination be necessary a specimen may be stained whole in Magenta Red and dissected in xylol-balsam. The procedure is as follows:

The specimen is passed to absolute alcohol; several drops of Magenta Red in absolute alcohol acidified with acetic acid are added and left for 2-5 minutes. Excess of stain is washed out with alcohol. Xylol (free of water) is then dropped into the last watch-glass of alcohol until no further milkiness is obtained. The specimen is then dried and transferred from this glass to pure Xylol for 5-10 minutes, and then dissected in 50-50 xylol-balsam. The stained mounts obtained tend to fade a little in course of time, but this disadvantage is slight in consideration of the sharp and clear detail which can be obtained under the highest powers. The method has an added advantage with crustacean chitin in that specimens are not rendered brittle or tough. It has been used for Isopoda, Cumacea, and Amphipoda with equal success.

QUASIMODIA WOMERSLEYI sp. nov.

Body depressed, dorsal ridge tuberculate, each segment forming a rounded prominence, first segment with a pseudo-rostrum on the mid-dorsal line, projecting

cowl-like over the head. The last peraeon, and first pleon segments are projecting backwards in prominent tubercules. Remainder of pleon small and carried well under the body. All segments developed.

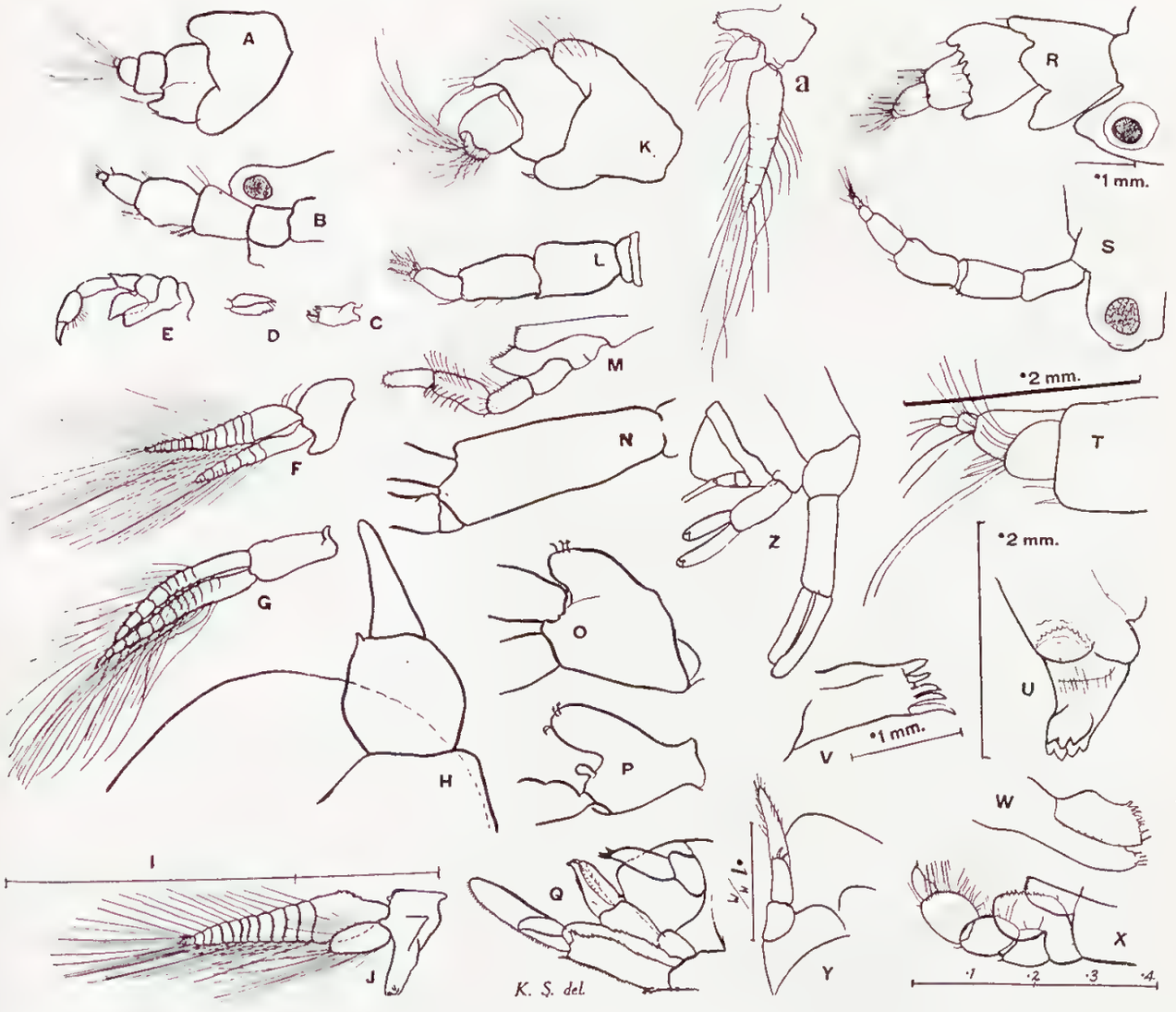

Fig. 5. A–a, *Quasimodia*, gen. nov. A–J, *Q. barnardi*; A, antenna 1; B, antenna 2; C, maxilla 1; D, maxilla 2; E, maxilliped; F, pleopod 2; G, pleopod 1; H, uropod 3 and telson; I, scale of length of pleopod 1; J, pleopod 3 at scale I. K–Q, *Q. womersleyi*; K, antenna 1; L, antenna 2; M, maxilliped; N–P, peduncles of pleopods 1–3 with P showing inner ramus; Q, uropods 1–3 and telson. R–a, *Q. capricornis*; R, antenna 1; S, antenna 2; T, accessory flagellum of antenna 1; U, mandible; V, maxilla 1; W, maxilla 2; X, maxilliped; Y, telson and uropod 3; Z, uropods 1–3 and telson; a, pleopod 3.

Side-plates as in *Iphiplateia*. Branchae leaf-like and uniform. Side-plates 5-7 lightly bilobed, very small. Eyes moderately prominent, oval and slightly raised. Antenna 1, first joint the largest, dorsal and ventral edges strongly produced forwards, ventral projection setose, dorsal terminating in a spine. Third joint small; flagellum one-jointed, button-like, very strongly setose. Antenna 2 like *Iphiplateia*, but with a single-jointed setose flagellum.

Mouth parts as for *Iphiplateia,* but mandible with flattened rounded process representing molar tubercule, maxillipeds, palp with joints long and slender; fourth long, tipped with short hairs; inner plate more rounded than in *I. whiteleggei,* outer with forward angles acute.

For gnathopods and peraeopods see comparative figure (fig. 6, E-K).

Peraeopod 5 with fourth joint only moderately expanded, this appendage the longest.

Pleopod 1 with peduncle three times as long as broad, nearly cylindrical, inner ramus slightly the shorter. Pleopods 2-3 as in *Iphiplateia.*

Uropod 1, peduncle spined on inner margins, as long as outer ramus, twice as long as hooked inner ramus. Uropod 2, as long as peduncle of first and nearly as stout; subequal rami nearly as long as peduncle. Uropod 3 projecting beyond telson, peduncle short and rounded; single ramus, a slender cone tipped with three spines. Twice as long as peduncle. Telson subtriangular, entire, smooth.

Size, 4 mm.

Loc. South Australia: Yorke Peninsula, Inneston. Reef, below low tide (H. Womersley, Entomologist to the South Australian Museum), after whom the species is named; Apl. 1936). Type in South Australian Museum, Reg. No. C. 2078.

QUASIMODIA CAPRICORNIS sp. nov.

Body like *Q. womersleyi,* but tubercules not so pronounced. First segment only slightly produced forwards. Backward production of first pleon segment not so pronounced, pleon only moderately depressed. All segments distinct, but sixth very small. Side-plates with angles squarer than for *Q. womersleyi.* Eyes moderately prominent. Antenna 1: first and second joints expanded, third about half as long as first, flagellum two-jointed with an accessory setose scale arising from the infero-distal edge of the third joint of the peduncle. Antenna 2: flagellum three-jointed. Mandible: cutting edge quadri-dentate, secondary cutting edge tridentate, spine-row with weak, hair-like spines; molar, a rounded prominence. Maxilla 1: a single plate only with six spines. Maxilla 2: bilobed. Maxilliped with inner plate small, outer reaching half-way up second joint of palp, which is short and stout.

Peraeopods normal for genus (see fig. 6 L-R).

Pleopods 1-2 normal. Pleopod 3 with inner ramus very small, but bearing 7-8 setae.

Uropod 1: rami subequal, outer equal to peduncle, not hooked. Inner margin of inner ramus indented. Uropod 2: rami subequal, slightly hooked, outer ramus equal

to peduncle. Uropod 3 : outer ramus more than three times peduncle ; inner small, slightly longer than peduncle, very difficult to separate from outer, with two small hooks.

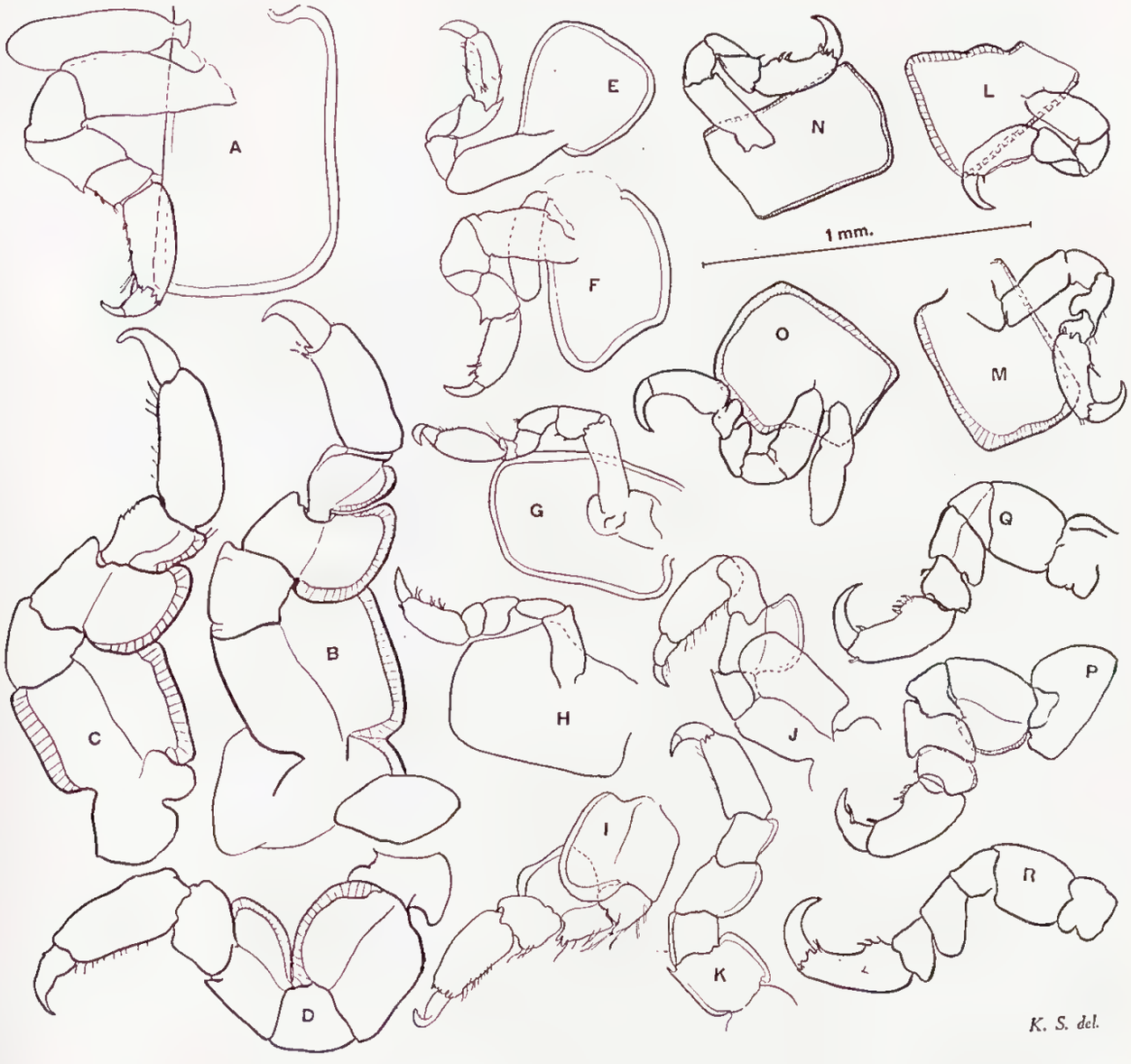

Fig. 6. *Quasimodia*, gen. nov. A–D, *Q. barnardi*; A, peraeopod 1; B–D, peraeopods 3–5. E–K, *Q. womersleyi*; E–F, gnathopods 1–2; G–K, peraeopods 1–5. L–R, *Q. capricornis;* L–M, gnathopods 1–2; N–R, peraeopods 1–5.

Telson triangular, entire.

Size, 4 mm.

Loc. South Australia : St. Vincent Gulf, Sellick's Reef, on rocks covered with algae and sand; 1 fath. (H. M. Hale, Apl. 1936). Types in South Australian Museum, Reg. No. C. 2075-2076.

QUASIMODIA BARNARDI sp. nov.

Body typical of genus, but appearing more massive owing to the greater development of joints 2-4 of peraeopods 3-5. First peraeon segment like *Q. womersleyi*. Antenna 1 short, second joint of peduncle expanded only on inner edge; flagellum two-jointed, second joint very small. Antenna 2 slender; flagellum with one joint. Mandibles and maxillae very small, but with the characters of the genus. Maxilliped with short plates and long slender palp, third joint as long as second, but rounded on inner side with long setae; fourth joint slightly hooked.

Peraeopods (see fig. 6, A-D). Peraeopods 1-2 like *Q. womersleyi* except that the fifth joint of peraeopod 1 is collar-shaped. Peraeopods 3-5 relatively massive, with the postero-distal margins of joints 2-4 strongly expanded.

Pleopod 1 with peduncle not expanded, biramous, longer than pleopod 2, and more than one and one-half times as long as pleopod 3. Pleopod 2 with peduncle prolonged, inner ramus the shorter. Pleopod 3 small with peduncle produced to a long process; inner ramus ovate, not segmented, as long as peduncle, bearing many setae.

Uropods 1-2 like *K. womersleyi* but not spined. Uropod 3 consisting of peduncle and ramus, peduncle projecting beyond telson, sub-spherical, as wide as long, ramus finger-like and equal to peduncle.

Telson entire, rounded, twice as broad as long.

Size 3 mm. Type female.

Loc. South Australia: Yorke Peninsula, Inneston (H. Womersley, Apl. 1936). Type in South Australian Museum, Reg. No. C. 2079.

Males and females bearing ova were collected in company with *Q. womersleyi* at Inneston, Yorke Peninsula.

A NEW PHREATOICID FROM THE GRAMPIANS, VICTORIA

By KEITH SHEARD, Hon. Assistant in Zoology, South Australian Museum.

Fig. 1-18.

Family PHREATOICIDAE.

Amphisopus ambiguus sp. nov.

Specific Diagnosis. Body moderately slender, surface smooth and free of hairs. Eyes moderately developed. Head not as long as first and second peraeon segments together; first peraeon segment completely fused on pleural line; first joint of first antenna longer and stouter than second or third. Fifth joint of second antenna long, first and second compressed. Right mandible with secondary cutting edge. Coxae of all legs fused. Sixth joint of the first peraeopod nearly circular (female and male); fourth peraeopod not differentiated; pleural walls of peraeon just covering arthroidal membrane of basis. Telson large, convex, but flattened dorsally, slight posterio-dorsal ridge flanked by two stout spines on either side. Uropods stout, basis extending to end of telson. Inner ramus longer than basis. Pleopods with epipodites on 3-5. Last joint of exopodites of pleopods furnished with plumose setae, penial filaments sickle-shaped and non-setose. Pleura of pleon well developed, concealing pleopods.

Colour, slatey-brown, with mottled markings.

The following detailed description is taken from three specimens which had been forwarded dry, and were in consequence slightly damaged.

The body is slender. Ratio $\left\{\frac{\text{Pleon and Telson}}{\text{Peraeon and Cephalon}}\right. = \frac{60 - 64}{100}$

The three specimens fall within this range. In a specimen 24 mm. in length the following measurements obtain:

	Length.	Width.	Depth.
Cephalon	5 mm.	3 mm.	3 mm.
Free peraeon	10	3	2·5
Pleon	6	3	4
Telson	3	3	2·5

Head: Dorsal surface convex. Anterior edge projects slightly over basal joints of antennae. Eyes small. No trace of line of fusion of first segment; line of fusion of second segment marked with a slight groove—this is more prominent on the side-plate.

Peraeon: Semi-cylindrical; pleura of segments 2-4 slightly developed, just covering the arthroidal membrane of the basal joints (coxal joints of the first peraeopods uncovered).

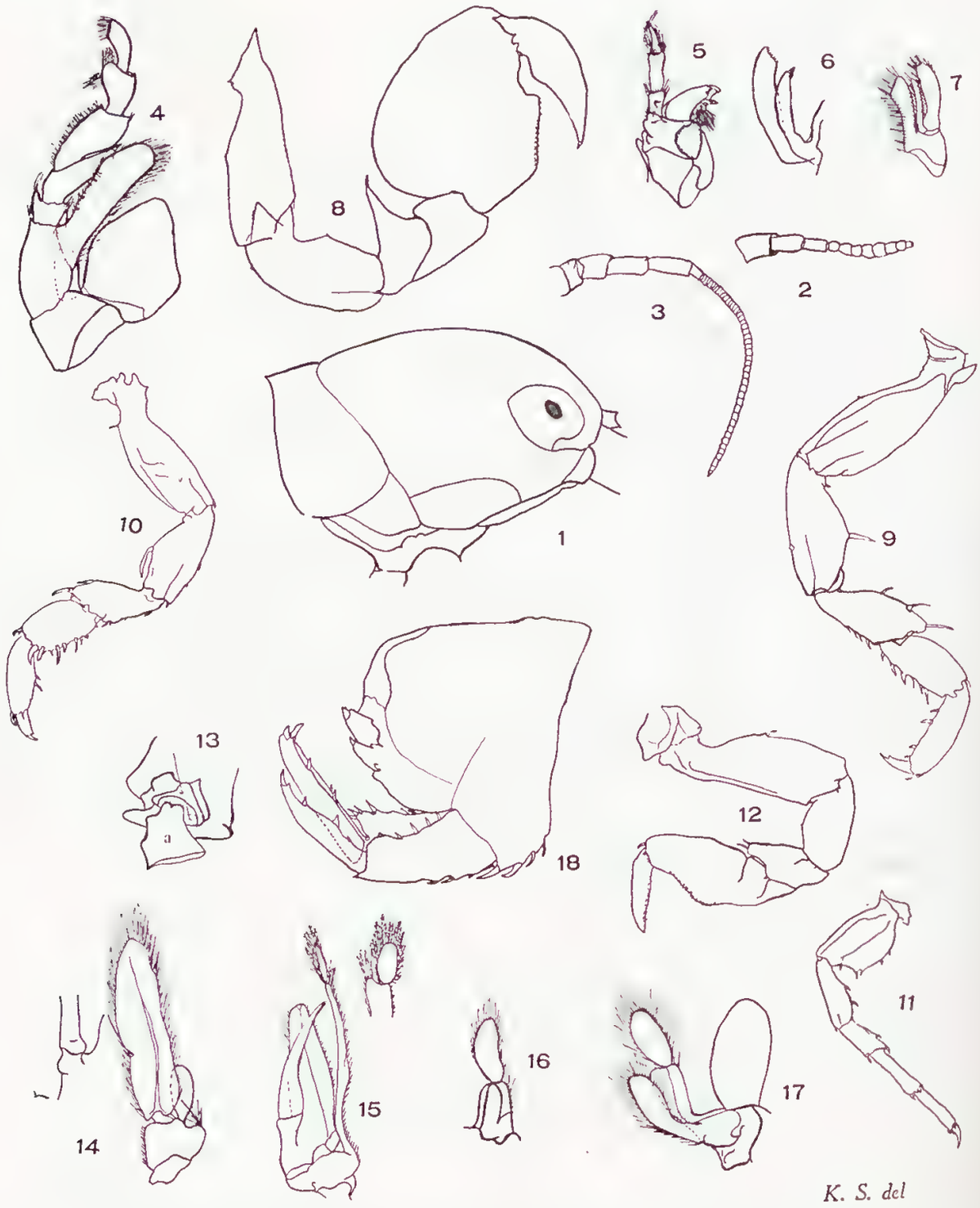

Fig. 1–18. *Amphisopus ambiguus*; 1, cephalon; 2, first antenna; 3, second antenna; 4, maxilliped; 5, mandible; 6, first maxilla; 7, second maxilla; 8, gnathopod (♂) 9, second peraeopod; 10, fourth peraeopod; 11, seventh peraeopod; 12, gnathopod, (♂) regenerated; 13, coxa, (♀) fourth peraeopod; 14, first pleopod; 15, second pleopod; 16, third pleopod; 17, fourth pleopod; 18, telson and uropod.

Pleura of segments 5, 6, 7 are progressively deeper, and possess a terminal spine anteriorly; 3, 4, 5 equal in length, and twice length of 2; 7 equals 2 (1 mm.), 6 subequal.

Pleon: First segment slightly narrower than last peraeon segment; free edges ovate, and fringed with moderate spines, not notched. Sixth fused to telson, line of fusion marked obliquely on the lower half of the side wall. There are no spines on this line, but four stout spines are carried on the anterior ventral edge of side-plate of the segment.

Telson: Large, dorsal line flatly convex in profile; transverse section horseshoe-shaped, with forward edge flattened. Posterio-dorsally a slight ridge occurs in the median line; this is smooth and not tipped by a spine, but is flanked on each side by a ridge, which, originating from the anterior end of the median ridge, describes a semi-circle and, after running parallel with the median ridge, meets the base of the largest posterio-lateral spine. A shallow depression is thus formed on each side of the median ridge. The posterio-dorsal aspect between the ventral edge of the telson immediately above the anal opening, and the slight projection of the median ridge is hollowed, triangular in shape, with a curved base. The posterio-lateral margins of the telson on level with this base terminate on each side in a large spine; below this is a second, smaller, and below this a third, very small. There is no median terminal protuberance or spine. This sculpture of the telson is typical of the species.

First antenna reaches to the middle of the fourth joint of the peduncle of the second. Peduncle: first joint stout, second and third progressively shorter and more slender, non-setose.

The second antenna reaches to the sixth peraeon segment. First joint of peduncle compressed and stout, second comparable, third longer and slenderer, fourth and fifth progressively longer and slenderer. Fifth equals twice third. The flagellum is twice as long as the peduncle, and consists of about 40 joints, the first being made up of several partially-fused joints.

The mandibles agree in general shape with those of *P. australis* (as figured by Chilton, Records Aust. Mus., 1891, and as noted in specimens kindly furnished by the Australian Museum), but are less setose, with no plumose setae evident. There is a rudimentary cutting edge on the right mandible, without teeth, and the spine-row has become a spine nodule bearing a tuft of hair-like spines. The palp, with the left stouter and longer than right, is three-jointed, second joint the longer, third a stout, curved finger; long simple setae arise from the anterior margins of the joints. (In *P. australis* both palps appear to be of equal development.)

The first maxilla has its inner lobe arising from a swollen base, and bears four large simple setae and one small seta on its distal edge; the outer lobe, one and one-

third as long as the inner, bears 25 curved, spine-like setae on its distal edge, forming a comb-like structure.

The second maxilla is comparable with that figured for *P. australis*; the base is reduced, the three lobes are fringed on their inferior edges with serrulate setae. Palp one-jointed, inner lobe bearing an accessory row of stiff simple setae close to the inferior margin. No plumose setae are visible on the maxillae. Lower lip bilobed.

The maxilliped: First joint with large epipod, one edge of which normally fits in a groove cut in the second and third joints; second joint, the longest, bearing a plate, which reaches to the middle of the fifth joint, is fringed with long, simple setae; is nearly four times longer than broad, and which bears six coupling hooks on its inner edge. The third joint is the shortest, about two-thirds as long as broad. The superior edge of the fourth joint is strongly produced forwards; the fifth is subequal to the second; sixth and seventh subequal, and furnished with long tufts of setae. The whole appendage is strong and well developed.

Gnathopod and peraeopods: The coxae are completely fused in both male and adult females (see fig. 13 a, second joint), of all legs. The gnathopod is strong and powerful in the male, that of the female being very much more slender, and with the "hand" smaller than that of the male, and bearing on the distal edge of the seventh joint a thick tuft of long hairs. The hand is subcircular, the sixth joint being two and three-quarters the width of the fifth. The palm bears blunted tubercles on its distal border. The seventh joint is stout, and terminates in a secondary unguis.

The second and third peraeopods are equal, with the fourth slightly shorter, and not differentiated in the male except that the spines of the fifth joint are stouter and more numerous. Otherwise these appendages are similar to those of *P. australis*, except that the spines, although less numerous, are relatively very stout.

The fifth, sixth, and seventh peraeopods are similar to *P. australis*, the spines which occur on the second, third, and fourth joint being short and more curved, with a few short scattered hairs among them. Each of the peraeopods bears a small bifid unguis.

Pleopoda: These are normally just hidden by the pleural walls of the pleon, and all bear plumose setae on the terminal joints of the exopodite. The second pleopod closely resembles that of *A. lintoni*. The penial filament, bearing no setae, is equal in length to the endopod; is sickle-shaped, and appears to be freely jointed. The second joint (ovate) of the exopod bears plumose setae on its distal half.

The uropod is very stout, basis extending to the end of the telson. Outer ramus equal in length to basis; inner longer, proportion 9 : 7. The rami are slightly hollow on their dorsal surfaces, and each edge is stoutly spined. The outer ramus is tipped with one spine, inner with four. The upper edge of the base is strongly concave, edges spined. The inner edge is produced posteriorly to a stout boss, tipped with three spines; the ventral edge of the fused sixth segment bears four stout spines.

The penes is a paired organ arising from the base of the fused coxae near the posterior edge of the last thoracic segment. It is non-setose.

Loc. Victoria: The Grampians, Fish Falls (R. V. Southcott, Dec., 1935). Types in South Australian Museum, Reg. No. C. 2115, 2116.

I am indebted to the Directors of the Australian and National Museums for specimens of *P. australis* and *P. terricola*. *A. ambiguus* was found under stones in damp places at Fish Falls, and in structural details and general shape closely resembles *Amphisopus lintoni* (Nicholls) and *A. palustris* (Glauert). The telson and uropods are unlike those of *P. terricola*. The new species may be readily separated from the other members of the genus by the uropods, which have the inner ramus longer than the outer.

I have followed Nicholls (1926) in the naming of this genus, as it antedates Shepherd's excellent revision of the family (1927).

Useful discussions of this family are to be found in the following papers:

Nicholls and Milner, *Journ. Roy. Soc. W. Aust.*, x, No. 6, 1923, p. 23.
Nicholls, *loc. cit.*, x, No. 13, 1924, pp. 92-104.
Nicholls, *loc. cit.*, xii, 1926, p. 179.
Barnard, *Trans. Roy. Soc. S. Africa*, xiv, 1927, pp. 139-161 (Biological study).
Shepherd, *Proc. Zool. Soc. London*, 1927, pp. 81-124.

The reference lists in the above papers contain the full bibliography of the family.

FURTHER RECORDS AND DESCRIPTIONS OF AUSTRALIAN COLLEMBOLA

By H. WOMERSLEY, F.R.E.S., A.L.S., Entomologist, South Australian Museum.

Fig. 1-7.

Collembola-Arthropleona Börner 1901.

Genus Pseudachorutes Tullbg. 1871.

Pseudachorutes evansi sp. n.

Fig. 1 a-f.

Description: Length to 5·0 mm. Colour (in spirit) blue-black dorsally, creamy-white on venter between coxae, on ventral tube, and on the furca. Antennae about as long as head diagonal; ratio of segments = 15 : 15 : 10 : 22, IV slightly clavate and wider than II and III, and without olfactory setae but with trilobed apical knob, sensory organ on III indeterminate. Ocelli 8 on each side on dark fields, equal. Postantennal organ slightly larger than a single ocellus, and with six peripheral lobes as figured. Legs, short and stout; claws with basal inner tooth and a pair of distal lateral teeth; empodial appendage wanting; clavate tibiotarsal setae absent; surface of claws strongly granulated. Furca well developed, mucro about one-fourth the length of dens with inner and outer lamellae, which terminate before the blunt apex, dens with six long ventral setae. Mandibles present with strongly-toothed head but no molar plate. Maxillae with two distinct serrated apical lamellae. Clothing of sparse short setae. Cuticle granular.

Locality: About half a dozen specimens collected by Mr. J. W. Evans on Mt. Wellington, Tasmania, September, 1935.

Remarks: Very near to *P. algidensis* Carp., 1925, from New Zealand, but differs in the number of lobes in the postantennal organ, in having a strong basal inner tooth to the claw, as well as a pair of strong distal teeth, and lastly in the form of the mucro.

Pseudachorutes tasmaniensis sp. nov.

Fig. 1 g-l.

Description: Length, 4·0 mm. Colour bluish dorsally, lighter on venter. Antennae about the length of head diagonal, ratio of segments = ? : ? : 10 : 15, IV without olfactory setae but with trilobed apical knob, III with sensory organ as

figured, the two sensory rods being curved and apically bifurcate. Mandibles without molar plate but with large head having fewer but stronger teeth than in preceding species; maxillae with two long apical lamellae. Ocelli eight on each side on dark fields, equal. Post-antennal organ of the *rhaeticus* type, elongate, twice as long as one ocellus, and with about 20 peripheral lobes. Legs short and stout,

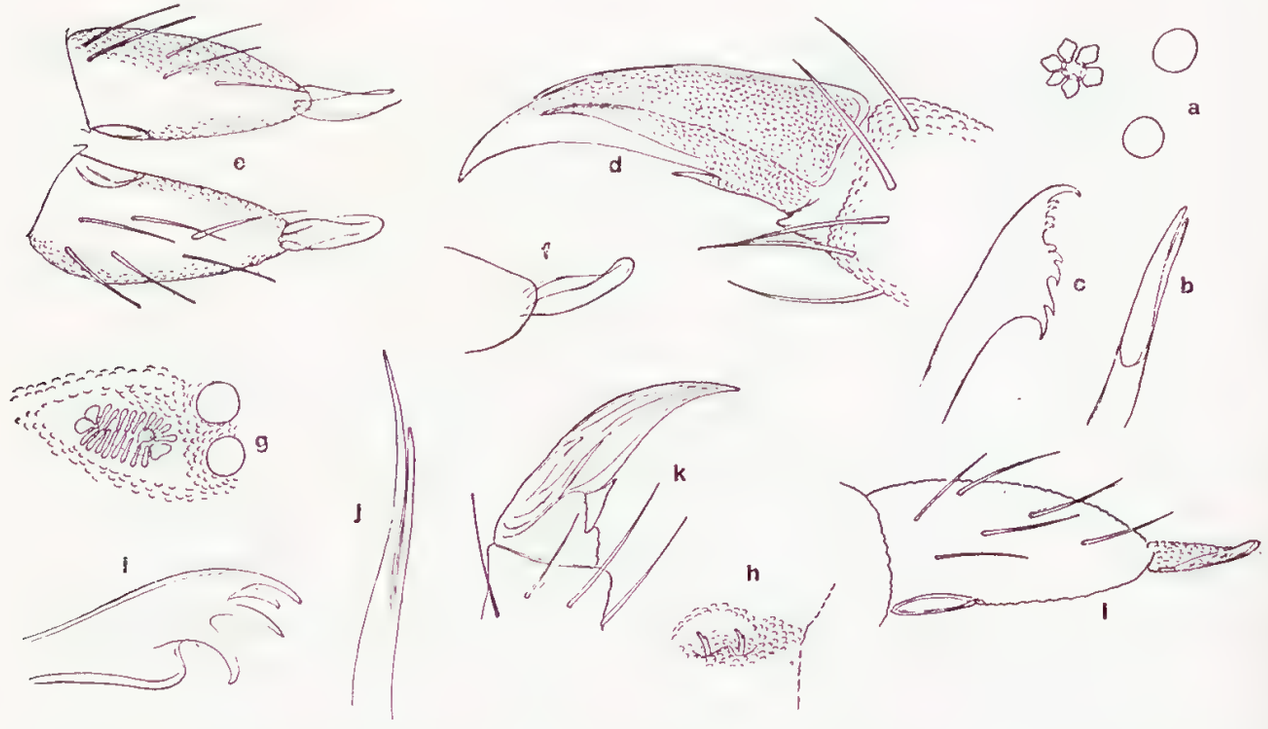

Fig. 1. *Pseudachorutes evansi* sp.n.; a, two anterior ocelli and p.a.o.; b, head of maxilla; c, head of mandible; d, claw and tip of tibiotarsus; e, mucrones and dentes from below; f, mucro from side. *Pseudachorutes tasmaniensis* sp.n.; g, p.a.o. and two anterior ocelli; h, sensory organ on ant. III; i, head of mandible; j, head of maxilla; k, claw; l, mucro and dens from side.

without clavate tibiotarsal setae; claws without inner or lateral teeth, and not distinctly granular. Furca well developed, mucro about one-third the length of dens as figured, dens with six ventral setae. Clothing short and sparse. Cuticle slightly granular.

Locality: Two specimens from Mt. Wellington, Tasmania, collected by Mr. J. W. Evans, September, 1935.

Remarks: Close to *P. rhaeticus* (Carl), but differs in the larger post-antennal organ with its greater number of lobes, the shape of the mucro, and the absence of teeth to the claw.

NOTES ON THE AUSTRALASIAN SPECIES OF *PSEUDACHORUTES*.

Eight species of this genus are now known from the Australasian region: one from Java, three from New Zealand, and four from Australia. Among the last,

P. rhaeticus (Carl), well-known in Europe, may be an introduction; *P. incertus* Schött, from Queensland, is inadequately described, and fresh material is required for detailed study. The following key will help to separate the eight species.

1. Ocelli 5 on each side. P.a.o. with 3-4 lobes. Claws without teeth. Two clavate tibiotarsal hairs. Mucro with 2 teeth (?).
P. incertus Schött 1917, Queensland.
Ocelli 8 on each side .. .. 2.
2. P.a.o. elliptical with 10 or more lobes .. .. 3.
P.a.o. circular with fewer lobes .. .. 4.
3. P.a.o. twice as long as one ocellus, with 20 peripheral lobes.
P. tasmaniensis sp. n., Tasmania.
P.a.o. only as long as one ocellus, with 10-15 lobes.
P. rhaeticus (Carl), Australia, Europe.
4. Colour "carmine". P.a.o. not longer than a single ocellus, and with 3-4 lobes.
P. javanicus Handschin, Java.
Colour not carmine .. .. 5.
5. P.a.o. with 4 lobes. Colour dark brown *P. pacificus* Wom., New Zealand.
P.a.o. with 5 lobes. Claws without teeth, lateral edges with transverse ridges.
P. algidensis Carp., New Zealand.
P.a.o. with 6 lobes. Claws with basal inner and a pair of distal lateral teeth, lateral surface granulate .. .. .. *P. evansi* sp. n., Tasmania.
P.a.o. with 8 lobes. Claws with inner tooth in distal half, lateral surface not granulate .. .. .. *P. brunneus* Carp., New Zealand.

Genus ACHORUTES Templ. 1834, Börner.

ACHORUTES HIRTELLUS v. WELLINGTONIA v. nov.

Fig. 2 a-d.

Very close to the typical Australian form *A. hirtellus* v. *cirratus* Schött, but differs in that the fine serrations on the stems of the dorsal setae are almost obsolete, in that the fimbriations at the apex of these setae are broader, and in the longer simple pointed setae on the head, pleural arears, and anal segments. It is also somewhat larger, ranging to 4·0 mm. in length.

Locality: About half a dozen specimens from Mt. Wellington, Tasmania, collected by Mr. J. W. Evans, September, 1935.

Genus ACANTHOMURUS Womersley, 1934.

ACANTHOMURUS PLUMBEUS v. LINEATUS Womersley, 1934.

A single specimen of this variety, as yet only known from Tasmania, was collected on Mt. Wellington, Tasmania, by Mr. J. W. Evans, in September, 1935.

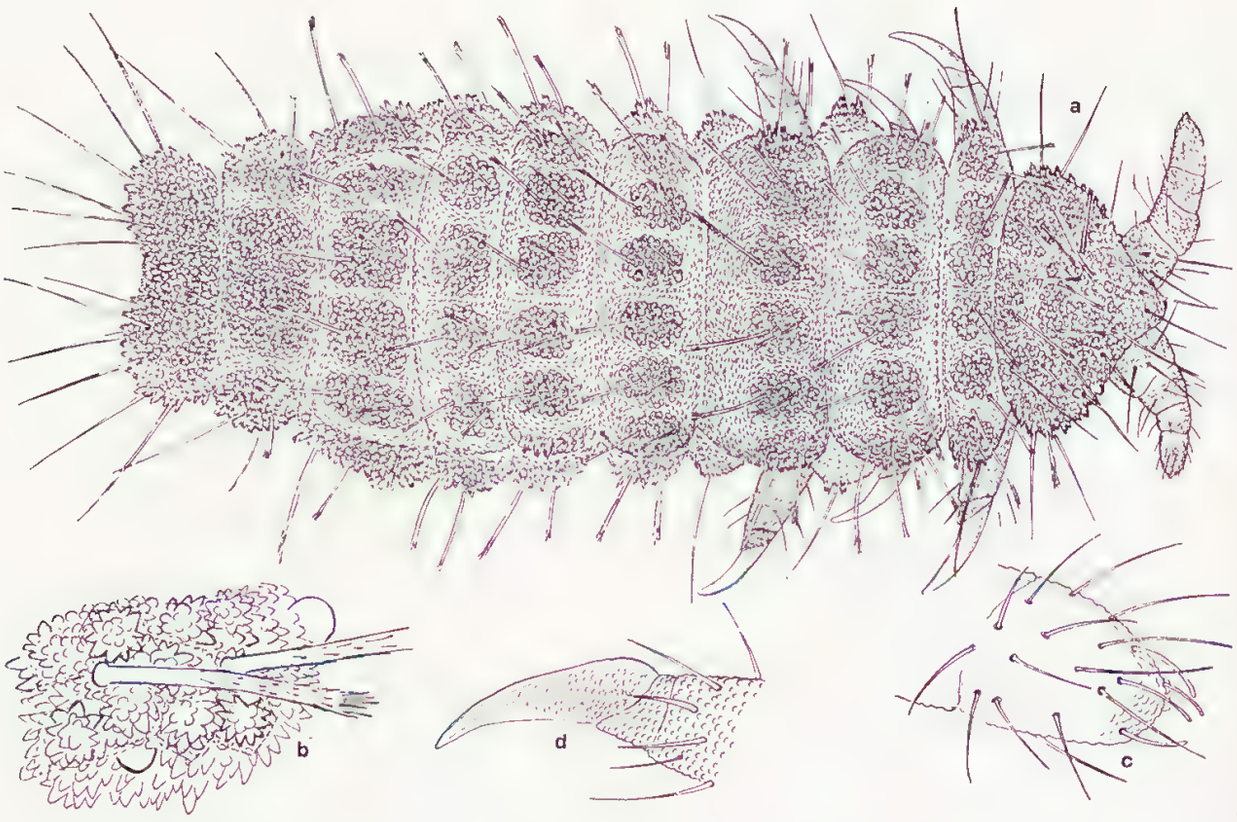

Fig. 2. *Achorutes hirtellus* v. *wellingtonia* v.n.; a, entire dorsal view; b, ocelli; c, tip of ant. IV; d, claw.

Genus ISOTOMA s. str. Börner.

ISOTOMA PRITCHARDI sp. nov.

syn. *Isotoma maritima* Tullbg. Wom. (Collembolan Fauna of New Zealand —in press).

Fig. 3 a-d.

In the above paper at present in the press I have recorded a number of specimens of an *Isotoma* collected by Mr. E. D. Pritchard, on the coast near Auckland, as the European *I. maritima* Tullbg. The specimens agreed in all details with this species except the number of the ocelli. These were uncertain, and although I could be sure of seeing only six on each side I assumed, as my preparations were not too clear, that there was the full number of eight.

Recently, however, Mr. H. M. Hale has collected some specimens on the reef at Sellick's Beach, S. Australia, March 8, 1936, which are identical with the New Zealand specimens, and in which the eyes are definitely only six on each side.

Such a close resemblance to the Northern *I. maritima* Tullbg. is paralleled in *Archisotoma bessèlsi* Pack of the Northern Hemisphere with eight eyes, and the

very close *A. brucci* Carp. from the Southern Orkneys and New Zealand, which differs principally in only having six eyes. The description of the new species is as follows.

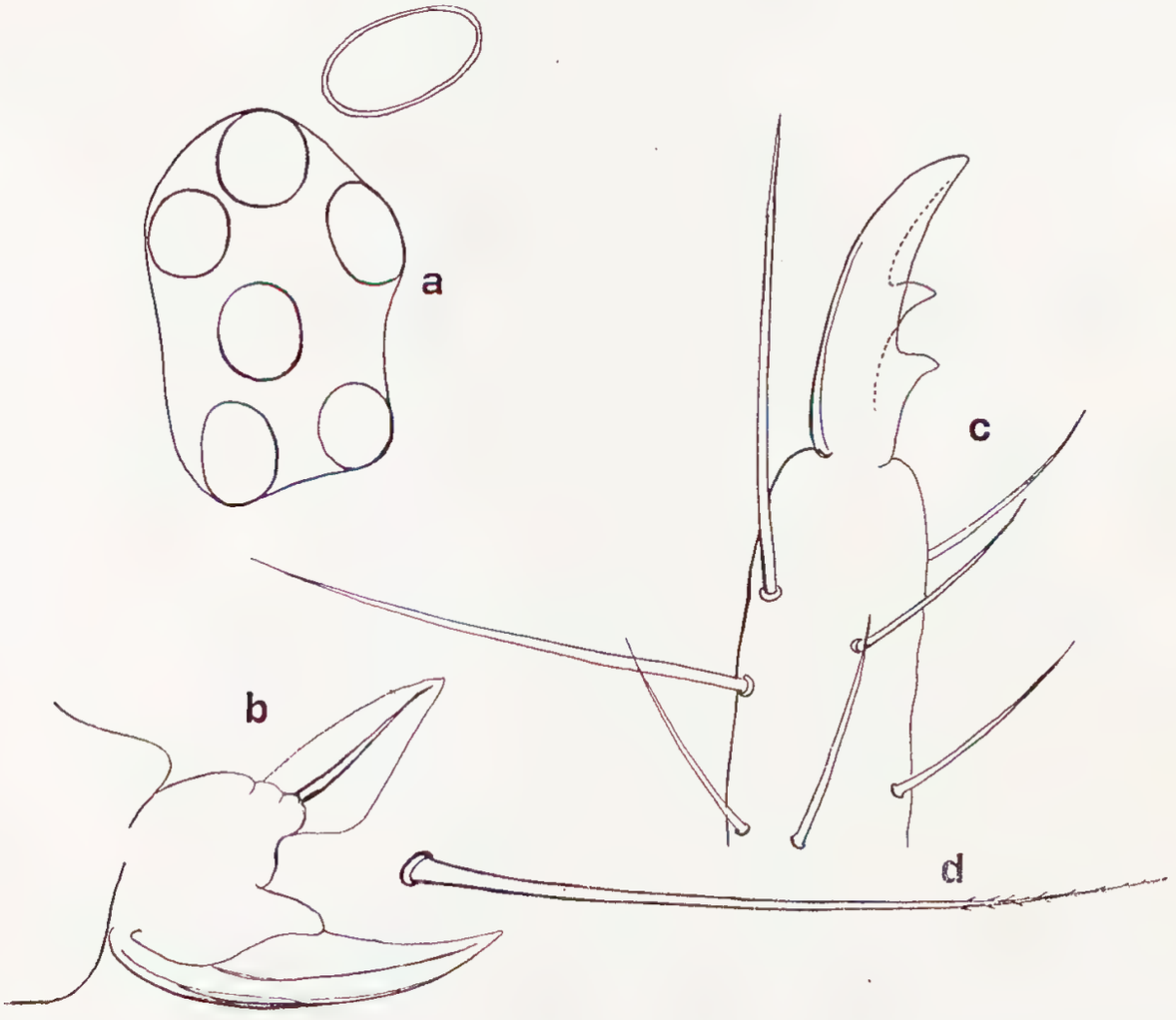

Fig. 3. *Isotoma pritchardi* sp.n.; a, ocelli and p.a.o.; b, foot; c, mucro and tip of dens; d, one of long setae of apical abdominal segments.

Description: Colour, greenish-black. Length to 1·8 mm. Antennae twice as long as head diagonal; ratio of segments = 35 : 55 : 55 : 75; IV broader just before apex than at base, III with sensory organ as figured. Eyes, six on each side, on dark fields, subequal. P.a.o. broadly oval, double-walled, and about one and one-half times as long as an ocellus. Body slender of typical *Isotoma* build, abdomen III and IV equal. Legs slender, claws without inner tooth, but apparently with a pair of outer fine teeth reaching to the middle of outer edge; empodial appendage with broad inner and outer lamellae. Furca slender, reaching ventral tube; mucro small, with three teeth as in *I. maritima*; dens apically with two long setae, one

over-reaching mucro. Clothing of moderately short simple setae, but on abdominal segments are some longer upstanding setae, which towards their apices are very finely ciliated.

Locality: On edge of reef, Sellick's Beach, S. Australia, March 8, 1936 (H.M.H.). Co-type material from Auckland, N.Z.

Genus ENTOMOBRYA Rondani, 1861.

ENTOMOBRYA VIRGATA v. NIGRELLA Wom., 1934.

Two specimens From Mt. Wellington, Tasmania, in September, 1935, collected by Mr. J. W. Evans.

Genus PSEUDOSINELLA Schffr., 1897.

PSEUDOSINELLA FASCIATA Wom., 1934.

A single specimen from Mt. Wellington, Tasmania, in September, 1935, collected by Mr. J. W. Evans.

Genus MESIRA Börner, 1903.

MESIRA NIGROCEPHALA sp. n.

Fig. 4 a-c.

Description: Length to 3·0 mm. Colour: head entirely blue-black, thoracic and first three abdominal segments yellowish, with slight mottling and dark lateral edges; abdomen IV usually with a few dark markings, sometimes almost entirely black. Legs and furca light with a little mottling. Antennae about half the body length; ratio of segments = 16 : 25 : 18 : 37, IV annulated and with apical knob. Eyes eight on each side on dark fields. Ratio of body segments = head : th. II : III : abd. I : II : III : IV : V : VI = 32 : 22 : 15 : 7 : 10 : 10 : 57 : 10 : 4; mesonotum not overlapping head. Legs long; claws with outer basal teeth, a pair of inner basal teeth at one-third, and two distal inner teeth. Furca reaching ventral tube, mucro bidentate with basal spine. Clothing of dens of dark brown scales, with numerous short striations, and rounded apex; hairs on body normal.

Locality: A number of specimens from Korait, Victoria, collected by Mr. R. T. M. Pescott, on August 12, 1935.

Genus PERICRYPTA Ritter, 1910.

PERICRYPTA TASMANIAE sp. n.

Figs. 4 d-e, 5 a-c.

Description: Length to 3·0 mm. Antennae longer than the body; ratio of segments = 45 : 57 : 55 : 70, IV indistinctly annulated. Eyes, eight on each side on elongate black fields. Ratio of head = th. II : III : abd. I : II : III : IV : V : VI =

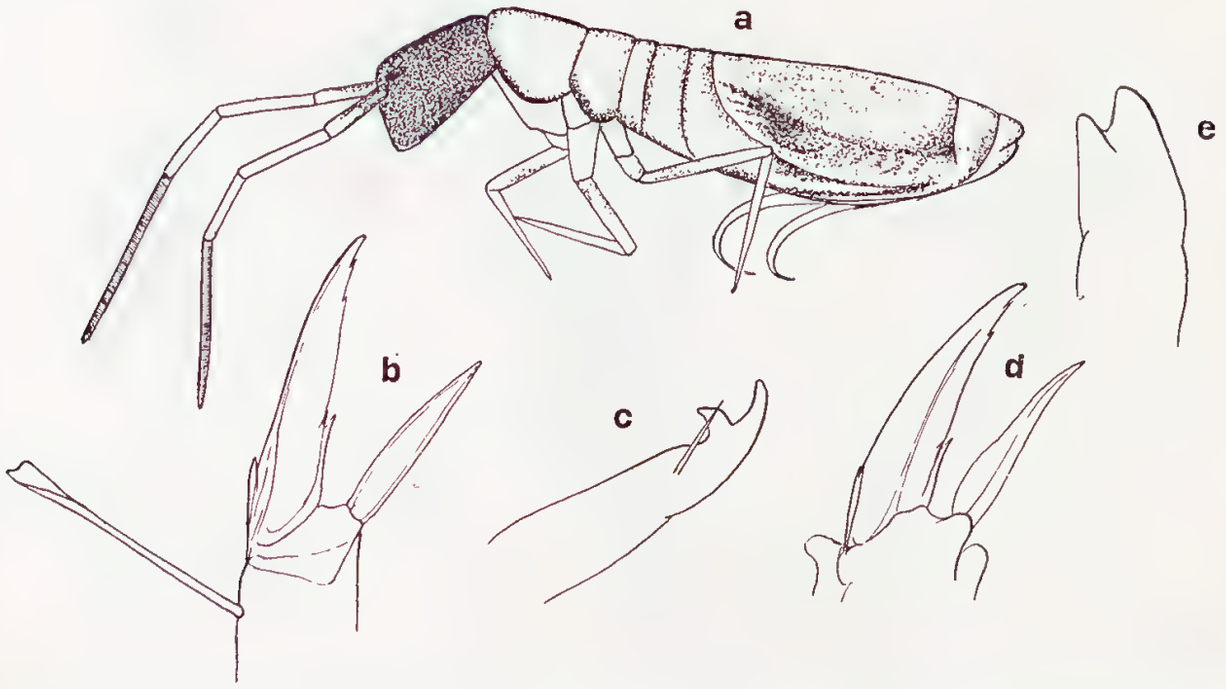

Fig. 4. *Mesira nigrocephala* sp.n.; a, entire lateral view; b, foot; c, mucro and tip of dens. *Pericrypta tasmaniae* sp.n.; d, foot; e, mucro.

35 : 20 : 10 : 8 : 10 : 8 : 60 : 8 : 4. Legs long and slender, tibiotarsus with plica, claws with a pair of outer basal teeth, a pair of basal inner teeth at one-third, and two fine distal teeth; empodial appendage slender, reaching first distal inner tooth. Furca long, reaching past ventral tube; ratio of manubrium to mucrodens = 47 : 60; mucro normal, with two blunt teeth. Clothing of normal setae.

Remarks: Of this interesting species there are three very distinct colour forms in the collection, two warranting varietal names. The colour descriptions are:

FORMA PRINCIPALIS.

Generally deep bluish on yellow ground, the blue pigment extending all over except for some light longitudinal striations. Legs heavily ringed with blue. Antennae light, except for a bluish ring at base of segments. Furca light.

var. MACULATA var. nov.

Ground colour yellow, head with a fine dark line between antennae, and brown on lateral edges; meso- and meta-thorax with brownish pigment laterally; meso- and meta-thorax and abdomen I and II with a pair of broken brownish medial

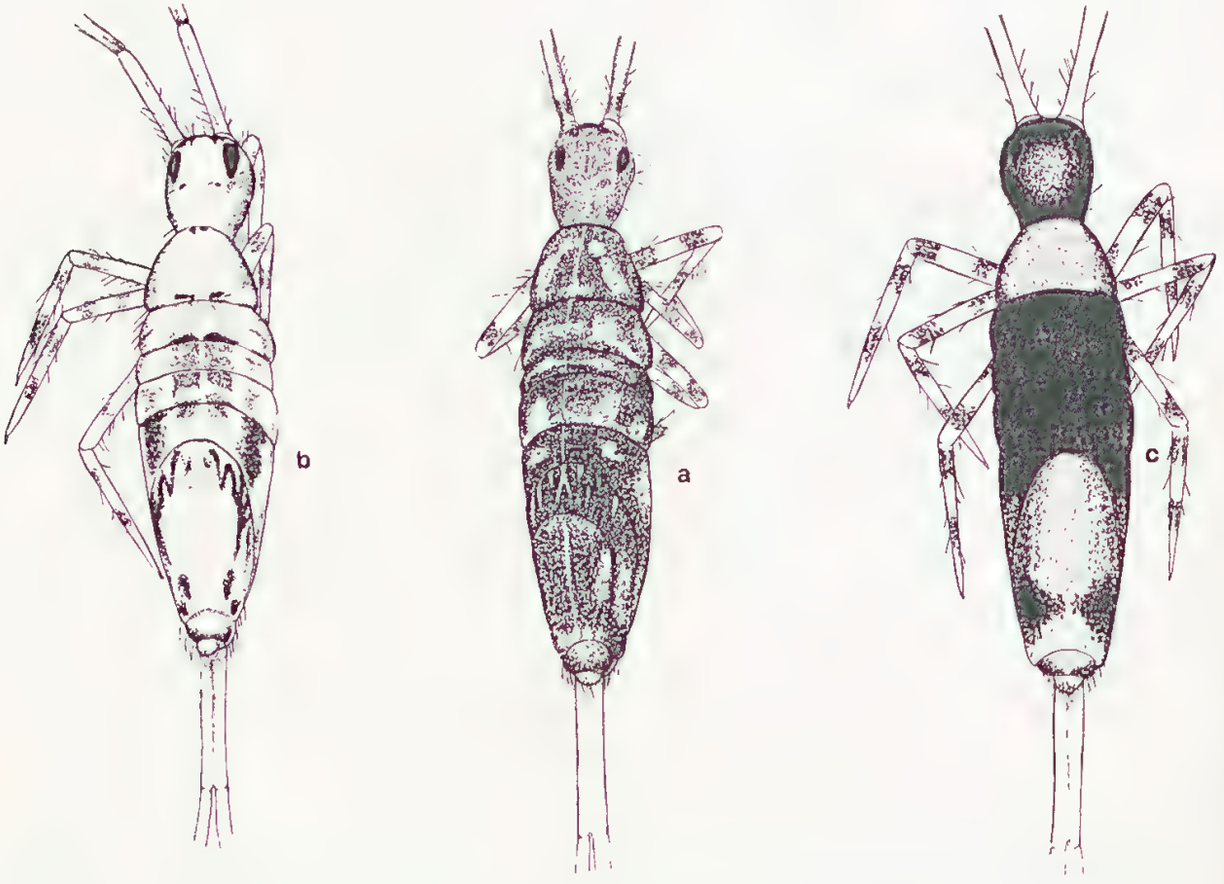

Fig. 5. *Pericrypta tasmaniae* sp.n.; a, *forma principalis*, entire dorsal view; b, *forma maculata* nov., entire dorsal view; c, *forma fasciata* nov., entire dorsal view.

longitudinal streaks. Abdomen IV anteriorly with an irregular transverse wavy line which in centre is brownish and laterally bluish-black; posteriorly there are two longitudinal streaks formed from two dark patches, the sides laterally slightly pigmented. Abdomen III sublaterally with broad brownish patches; V with posterolateral brown patches. Legs lightly banded; antennae blue at extreme base of segments.

var. FASICATA var. nov.

Head entirely black except for a median light patch. Meso-thorax only pigmented on lateral margins. Meta-thorax and abdomen I-III entirely black. Abdomen IV slightly pigmented laterally, this pigment darkening at about one-fifth

from apex, and here extending inwards but not meeting. Abdomen V with postero-lateral dark patches. Legs fairly strongly banded. Antennae without the basal segmental bands, but here with a small touch of blue ventrally.

Locality, About five specimens of the typical form and one each of the varieties from Mt. Wellington, Tasmania, in September, 1935, collected by Mr. J. W. Evans.

COLLEMBOLA SYMPHYPLEONA.

FAMILY SMINTHURIDAE LUBBOCK, 1876.

Genus KATIANNA Börner.

KATIANNA AUSTRALIS Wom., 1932.

Dunally, Tasmania, September, 1935, Mr. J. W. Evans.

Genus PARAKATIANNA Wom., 1932.

PARAKATIANNA MONTANA sp. n.

Text Fig. 6a.

Description: Length, 1·06 mm. Colour, greenish-black, with a longitudinal stripe of yellow inside of the eyes, and joined posteriorly by a transverse stripe of same colour; body with a thin median longitudinal stripe and four or five transverse, but forwardly inclined stripes all of yellow; anal segments with a pair of yellow dots. Antennae nearly twice as long as head; ratio of segments = 15 : 30 : 45 : 110; IV with 15 subdivisions, VII with peg-like organ. Eyes eight on each side on dark patches. Legs long and thin; claws slender without teeth; empodial appendage with narrow inner and outer lamellae, apparently without apical bristle on all legs; tibiotarsi with 2-3 clavate hairs. Furca long and normal; mucro one-third as long as dens, with slightly upturned apex and edges of lamellae smooth. Clothing rather sparse, of fine simple curved setae, those on antennae normal for the genus; bothriotrichia, three on abdomen on each side, and one on genital segments.

Locality: Three specimens collected by Master M. Trigg on Mt. Buffalo, Victoria, August, 1935.

Remarks: This species is very different from any other of the genus in its colouration.

PARAKATIANNA SERRATA sp. n.

Fig. 6 b-d.

Description: Length to 1·0 mm. Colour, mottley orange, with the apical antennal segments dark, and the eye-patches black; legs and furca light. Antennae

Fig. 6. *Parakatianna montana* sp.n.; a, entire dorsal view. *Parakatianna serrata* sp.n.; b, ant. III and IV; c, foot; d, mucro and tip of dens.

twice as long as head; ratio of segments = 13 : 20 : 35 : 70; IV with 8-10 subdivisions, last somewhat tapering; III with peg-like organ. Eyes eight on each side. Legs normal. Claws with fine inner tooth; empodial appendage with angular inner lamella and narrow outer lamella ending in a long fine-pointed bristle reaching tip of claw; two to three clavate tibiotarsal hairs. Furca, mucro : dens = 13 : 45; mucro with seven strong teeth as figured, the second and third from apex fused. Clothing of fine simple curved setae rather more numerous than in preceding species; bothriotrichia three on abdomen, one on genital segments.

Locality: Three specimens from Mt. Buffalo, Victoria, collected by Master M. Trigg in August, 1935.

Remarks: Differs from all other species of the genus in the peculiar teeth to the mucro, and in its colour.

PARAKATIANNA OBSCURA sp. n.

Fig. 7 a-e.

Description: Length to 1·25 mm. Colour, ground dirty yellowish-grey, with a longitudinal yellow patch medially between the eyes; two yellow spots before apex of dorsum, and one or two on anal segments dorsally; otherwise with black markings as indicated in text figures; some specimens have a lighter patch before apex of dorsum; antennae yellowish-grey, darker on apical segments; legs, furca

Fig. 7. *Parakatianna obscura* sp.n.; a, dorsal view of dark form; b, dorsal view of light form; c, lateral view; d, claw and tip of tibiotarsus; e, mucro from side.

and venter lighter. Antennae twice as long as head diagonal; ratio of segments = 3 : 9 : 11 : 28; III without peg-like organ, IV with about 16 subdivisions. Claws strong, with a basal inner tooth and two distal teeth, outer sheath absent; empodial appendage long and pointed with narrow inner and outer lamellae, reaching middle inner tooth of claw; inner lamella with short basal spine at angle, apex with short subapical bristle, alike on all feet; tibiotarsus with 4-5 long clavate tenent setae. Furca long, ratio dens : mucro = 100 : 20, mucro with broad outer lamella and narrow inner lamella, apex blunt; teeth only slightly indicated by faint crenulations. Clothing of sparse but strong setae, especially on head and anal segments, although not stronger than in most species of *Parakatianna*. Sensory setae three on body on each side, and one on anal segments.

Locality: A large number of specimens from Leeton, N.S.W., collected by Mr. K. C. McKeown, June 22, 1927.

Remarks: This is a second abnormal species of the genus agreeing with *Parakatianna anomala* Wom. in the absence of the peg-like organ on antennae III. From this species it differs in the dentition of the claws, clothing, and form of the mucro, as well as in colouration.

RESULTS OF THE EXCAVATION OF KONGARATI CAVE, NEAR SECOND VALLEY, SOUTH AUSTRALIA

By NORMAN B. TINDALE, B.Sc., Ethnologist, and
C. P. MOUNTFORD, Hon. Assistant in Ethnology.

Fig. 1-6.

During March, 1934, the opportunity occurred for a small party including Messrs. F. J. Hall (Hon. Assistant in Ethnology) and H. T. Condon (Assistant in Zoology) to excavate at Kongarati Cave, Hundred of Yankalilla. On March 20, 1934, stores were taken to the site by motor launch from Second Valley. Work continued at the cave until April 10. Several members of the Anthropological Society of South Australia, including Dr. T. D. Campbell and Rev. N. H. Louwyck, visited the site during the Easter vacation, and assisted in the work of excavation.

Kongarati Cave is situated on the seaward margin of Section 1589, 3·7 kilometres north of the mouth of Congeratinga Creek (Native name ['Koŋarati'ŋaŋk]). The cave has been eroded in the north-facing wall of the cliff, at a height of some eight metres above sea-level. By aneroid barometer reading the cliff immediately above the cave is 420 feet in height.

Kongarati cave has been known and visited since the earliest days of the white settlement in South Australia. A superficial layer of sheep dung over much of the surface indicated that at some time it had been used as a sheep fold.

THE EXCAVATION.

A point at the inner extremity of the cave was selected and arbitrarily determined as 10 metres above a base line situated somewhere below low water outermost spring tides.

Tide data are available for Port Willunga, Port Noarlunga, and Cape Willoughby. A temporary tide gauge was established near the mouth of the cave, and by means of Tide Tables(1) the level of L.W.O.S.T. proved to be (average of six readings) at 2·5 ± ·5 metres on an arbitrary scale.

In order to read an approximation to true sea-level it is thus necessary to subtract 2·5 metres from all contour heights shown in the diagrams of the cave in this paper.

(1) South Australia: Harbours Board, Tide Tables, 1934.

The cave was mapped and a contoured plan prepared (fig. 1). Upon it have been indicated a trial trench, the main excavation, in which detailed stratigraphical observations were made; later subsidiary trenches dug directly down to a sterile pebble beach layer revealed by the main excavation. Minor holes and trenches made by previous visitors to the cave are shown within dotted lines on the plan.

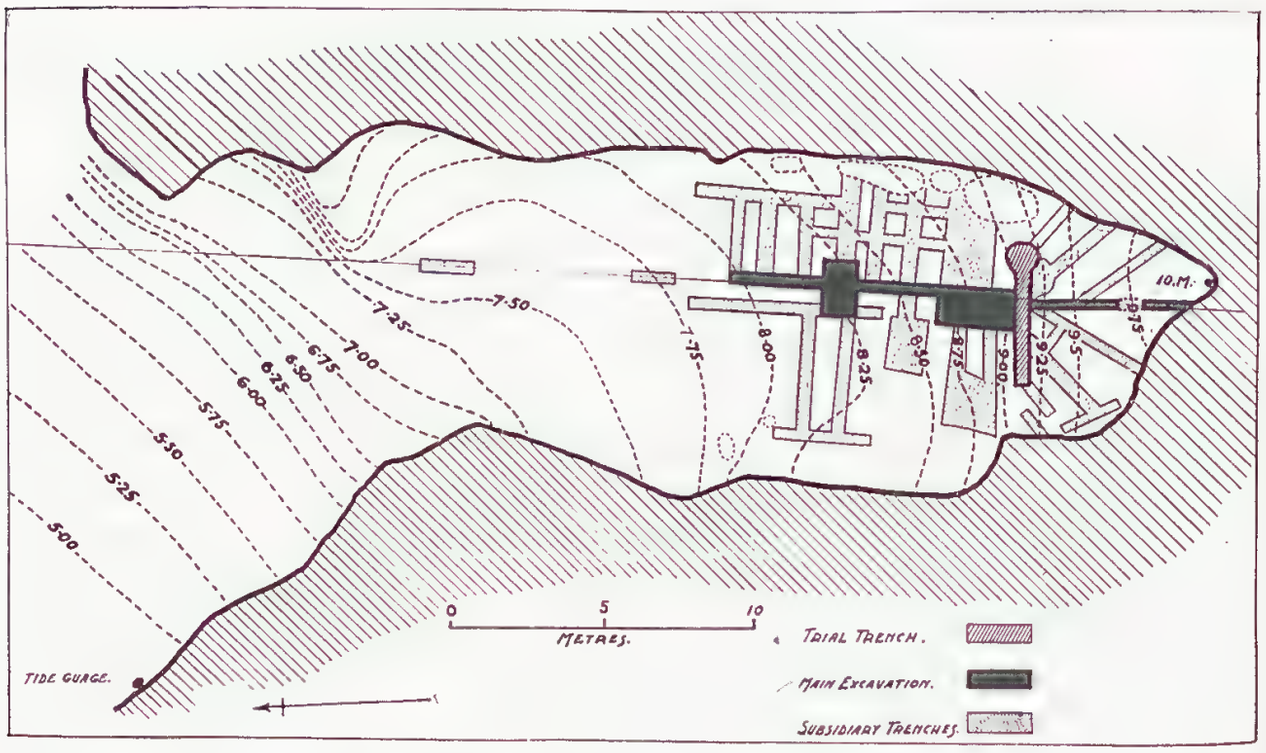

Fig. 1. Contour plan of Kongarati Cave.

Fig. 2 shows a section of the cave. It indicates that the basal bed is a shingle beach about 0·5 metre in thickness resting on the slate rock of the cave. This shingle bed is composed largely of slate and other pebbles, which are of the average size of 6 × 3 × 1·5 cm., and extends upwards and towards the back of the cave to our 8·2 metres, where its surface is almost horizontal.

The shingle beach indicates a definite phase of the history of the cave. Its origin dates back either to the time when the cave was first eroded by the sea or, alternatively, to a subsequent period when the sea reached a sufficint level to have removed all traces of earlier debris. No evidence of human occupation was obtained in the shingle bed, but occupational horizons appeared immediately above it, and continued to within about 5 cm. of the surface. A layer of post-European debris (averaging about 5 cm. in thickness, and including sheep manure) and flakes of slate which had weathered from the roof, lay immediately on top. A trial trench (fig. 1) 1 metre wide and 3 metres long was dug transversely across the cave be-

tween the 9·0 and 9·2 metre contours. The debris was removed from this in 15 cm. layers.

0–15 cm. yielded much charcoal, fragments of slate which had scaled from the roof, shell fragments (including *Nerita melanotragus*, *Mactra rufescens* and *Bembicium plana*) crab's claws, a few fragmentary fish bones, a small piece of chewed fibre, and a fire hearth; also fragments of *Spinifex inermis*, and chewed masses of fibre, probably from the same material.

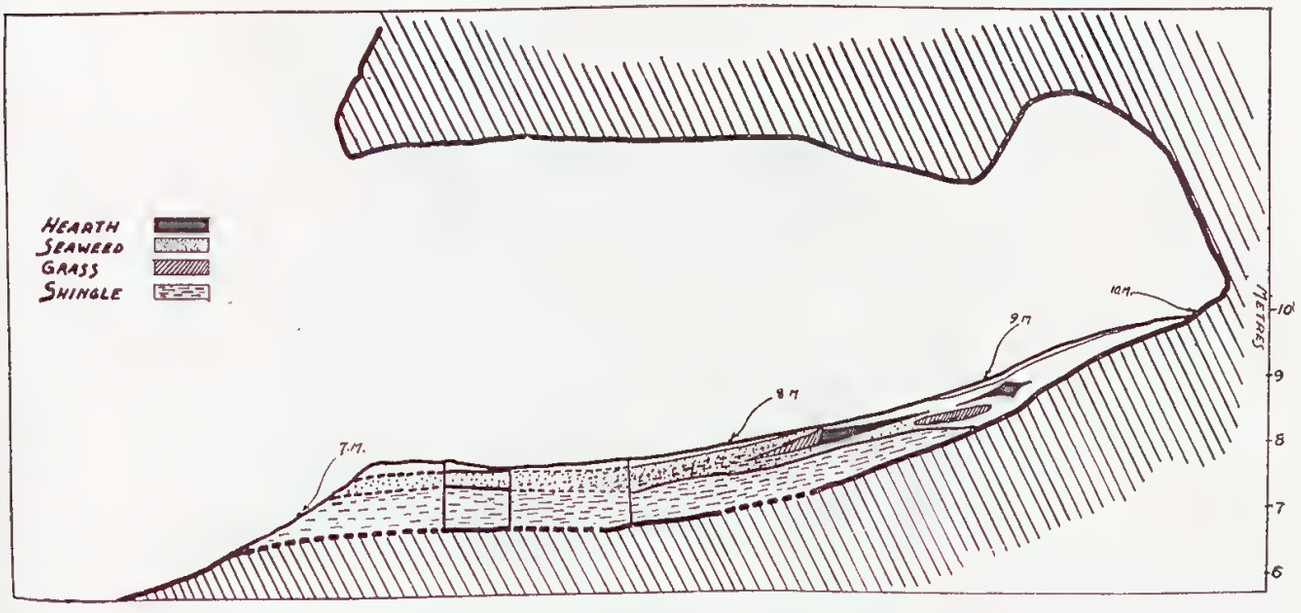

Fig. 2. Section of Kongarati Cave.

15–30 cm. Further quantities of ash, a hearth and a band of seaweed were noted. Species of shell present were *Bembicium melanostoma*, *Mactra rufescens*, and *Conus anemone;* plant, *Spinifex inermis*, *Lepidosporma gladiatum*, *Caostiarina* (sp.); string fragment probably made from *Dianella revoluta*; animal remains, *Bettongia*, *Isoodin*, *Murid*.

30-45 cm. At the eastern end of the trial trench and immediately under the seaweed layer, flat slabs of slate-stone, roughly rectangular in shape and about 30 cm. in diameter, were encountered. The lifting of two of the slabs exposed a layer of marine sponges, evidently placed *in situ* by natives, under which was a pad of grass. Several tufts in it were tied into knots. Beneath this grass pad, at a depth of 45 cm., was a kangaroo-skin cloak. The removal of this revealed the dessicated body of an elderly female aborigine, lying in a flexed position with its right side directed toward the north (fig. 3).

The body lay on a somewhat crumpled kangaroo skin, with strips of partly-decayed fishing nets draped around the shoulders and back.

A mass of granular material approximately 700 gm. in weight was found at the foot of the individual. If the material had been buried in a container, all signs of the latter had disappeared.

The tomb cavity, which had been excavated to bed rock through the white ash of a large hearth, was in the form of a rectangle, the walls and floor being composed of slabs of slate about the same size and shape as those already removed from the top of the grave. The stones used in the construction were similar to many lying on the terrace at the mouth of the cave.

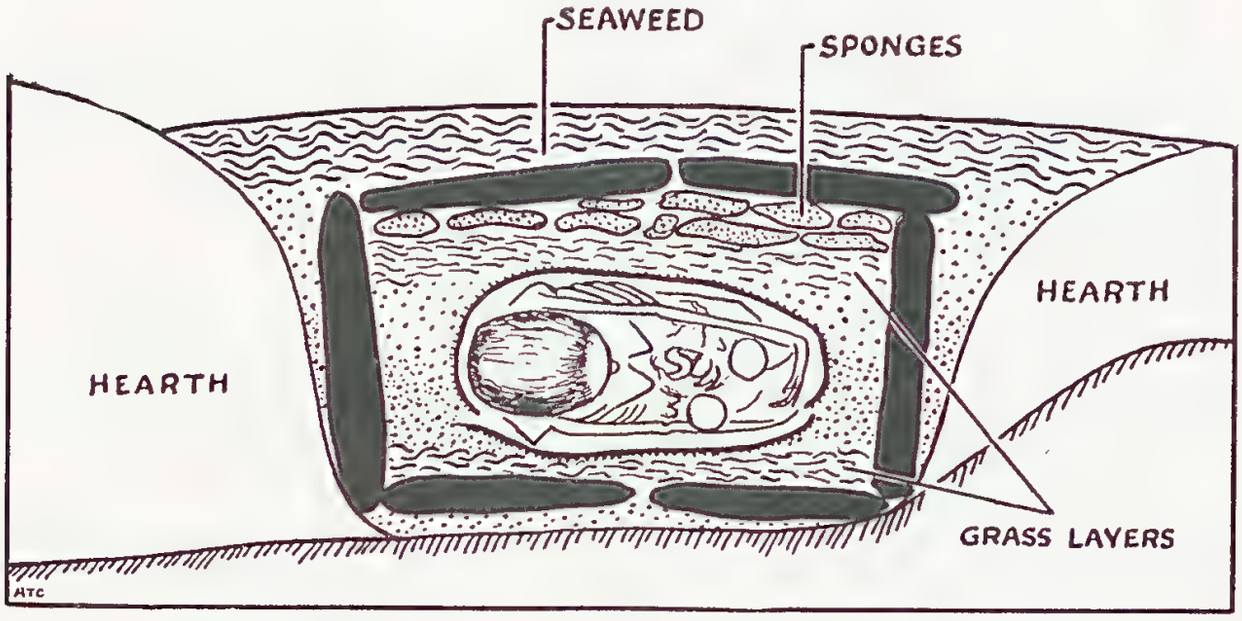

Fig. 3. Section showing method of burial in Kongarati Cave.

The stratification of the debris indicated that the grave had been excavated when the cave floor was some 20 cm. lower than at present, i.e. below the hearth at 15 cm. and above the seaweed layer at 30 cm.

The undisturbed hearth material in the trial trench, between 30 cm. and rock bottom, was removed and found to contain chewed fibre, a few shells, and a fragment of netting. The floor of the cave was almost horizontal. Shells in this layer were *Conus anemone, Verita malanotragus, Haliotus naevosa,* and *Saxicava australis* (which bores into limestone); bones of *Arctocephalus* cf. *doriferus,* and a cone of *Casuarina stricta* also occurred.

Nothing further of importance having been discovered in the trial trench, an excavation was commenced at right angles to the first; hereafter this is called the "main excavation". The principal details discovered by means of this trench are summarized in the general section (fig. 2). The part between 9·00 and 8·00 form lines, where most of the interesting specimens were unearthed, is shown in greater detail in fig. 4.

The lowest stratum of occupation (C) consists of a well preserved layer of grass, which in the section shows as a lenticule 10-15 cm. in thickness, resting upon a series of old flat slates (B), which appear to have been washed into their present situation about the end of the period when the main shingle beach (A) was being deposited.

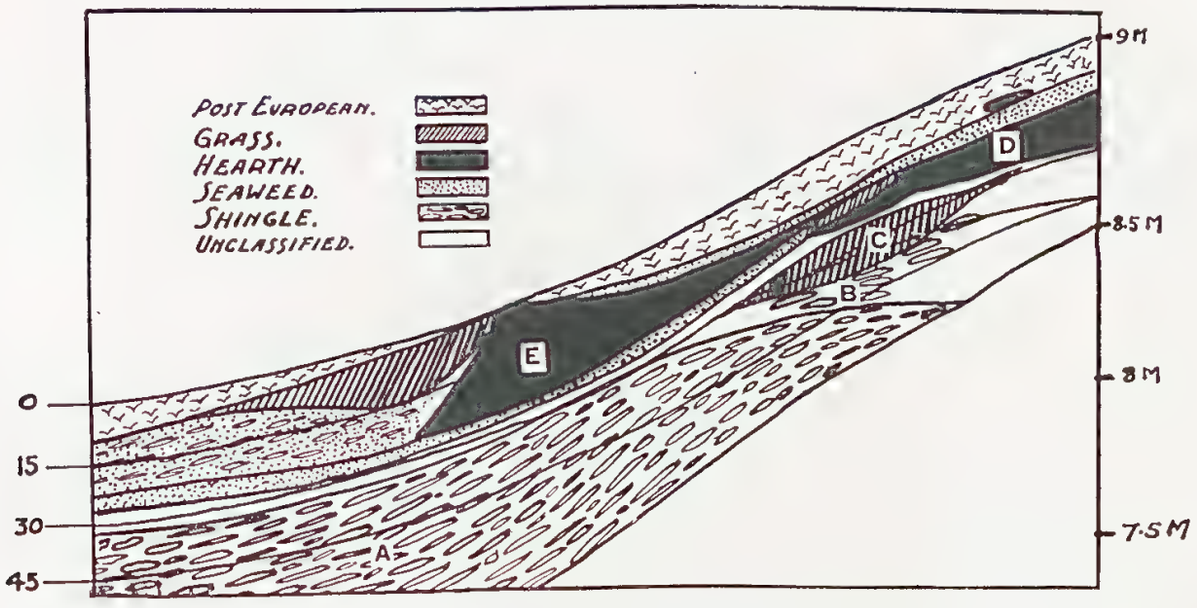

Fig. 4. Section of portion of floor of Kongarati Cave.

The shell fauna of this shingle beach is represented by specimens of the following species: *Bembicium melanostoma, Cassis bicarinata, Mactra rufescens, Turbo stamineus, T. undulata, Neothais textiliosa, Conus anemone, Nerita melanotragus, Austrocochlea adelaidae, Caminella lineolata, Haliotis scalaris, Trophon flindersi, Capulus conicus, Mitra glabra, Turritella iredalei.*

Undecomposed sponges lay below some of the stone slabs (B). Many of the pebbles in the shingle (A) were cemented together with crystals of salt. The debris of the grass layer (C) was also thickly impregnated with crystals and granules of salt. It may be remarked that salt crystals occurred in all subsequent layers, and are hereafter not particularized. Many of them had formed on the roof of the cave, as small stalactites, and had afterwards fallen down on to the floor of the cave.

The grass layer (C) yielded a sharpened stick, portion of a spear, and a bone awl or point. The shells found in this layer were *Turbo undulatus, Haliotis naevosa, Mactra rufescens, Turbo stamineus, Bembicium melanostoma, Neothais textiliosa, Patella limbata, Conus anemone.*

Section of the next layer (D) also appears as a lenticule of hearth material and ashy debris. Its greatest thickness, 18 cm., occurred just below the 9·00 form

line, and thinned towards the seaward end of the trench. The principal shells present in it were *Mactra rufescens, Turbo stamineus, Nerita melanotragus,* and *Bembicium melanostoma.* It underlaid a still larger hearth (E), from which it was separated by a thin but constant layer of grass. The hearth (E) continued upwards to the surface of the 8·25 contour. Its seaward face had been eroded away by wave action, such as may have been responsible for transporting some of the upper layers of beach shingle and seaweed into the cave, as revealed in the trench at the 8·00 contour. The shell fauna of these upper layers of beach shingle includes the following species: *Cardita crassicostata, Neothais textiliosa, Turbo undulata, T. stamineus, Mesodesma praecisa, Conus anemone, Equichlamys bifrons, Haliotis scalaris, H. naevosa, H. albicans, Mactra rufescens, Monodonta adelaidae, Trophon flindersi, Lyria mitraeformis, Bembicium melanostoma,* and *Nerita melanotragus.*

The area cut away from the hearth by the sea was subsequently filled with grass (F); the nether stick of a fire-drill was found here. The shells in this layer were *Mactra rufescens, Bembicium melanostoma, Conus anemone, Mondonta adelaidae, Turbo stamineus, Nerita melanotragus, Haliotis scalaris, H. albicans,* and *Capulus conicus.* There was much seaweed lying on top of the landward side of the hearth area. In the higher parts of the cave this seaweed layer rested above and below other smaller hearths. For convenience of excavation the debris from the main excavation was removed in three layers (1-3, respectively 0-15 cm., 15-30 cm., and 30-45 cm. below the surface). The preserved specimens are labelled therefore in the form "Layer x, between y and z metres", 0 metre being the seaward wall of the trial trench.

Mammal remains found in the main excavation were: *Trichosurus* cf. *vulpecula, Bettongia* sp., *Isoodon, Macropus cf. gigantus, Arctocephalus* (cf. *doriferus*), *Trachysaurus, Dasyurus* (cf. *viverrinus*), *Isoodon* sp. (cf. *obesulus*). (Three Murids; probably *Rattus greyi* and *R. lutreola* were collected here in 1931.)

The few feather and bone fragments of birds were too fragmentary for identification.

Miss C. M. Eardley has kindly commented on the plant debris dug from the floor of the cave. She writes:

"The remains consisted mainly of the succulent Pigface, *Carpobrotus aequilaterali* (*Mesembrianthemum aequilaterale*), often merely shrivelled; cones and woody shoot of a *Casuarina;* cane-like creeping stems of *Spinifex inermis* (*S. hirsutus*), together with leaves and fibrous material remaining from them; parts of stems or leaves of the Sword Rush (*Lepidosperma gladiatum*); *Dianella revoluta,* and a small piece of cord obviously made from its fibrous leaves; part of a flowering stalk of *Xanthorrhoea* sp. (Blackboy); odd leaves of *Scaevola crassifolia, Acacia*

sp. and *Myoporum* sp.; pods of an *Acacia* sp. without seeds. Besides this there were fragments of roots and woody stems, and a grass with creeping stems, and part of a grass inflorescence, probably of *Poa* sp. All these are common sandhill plants."

PHYSIOGRAPHICAL NOTES.

The rocks of the cliff are slates and metamorphic rocks of Pre-Cambrian age. They have been described by several gological writers (2).

Between four and seven metres above present low tide-mark occurs evidence of a notch or terrace in the cliffs, together with cemented shingle forming a basal conglomerate. In places this shingle is wedged into crevices on the old marine floor.

The principal exposure of the terrace is at a place half a kilometre north of the Cave on the boundary of Section 217 and 1596, where the cliffs stand back some fifty metres from the beach. Rounded beach shingle is at present at a height of six metres, and is overlaid by scree boulders and debris from the cliffs.

The second place where the terrace may be noted is at Pool Flat (Section 1588). Here the cemented base of the conglomerate is present at three metres above low water level, and the deposit fills the notch in the cliff, which stands back from the coastline. The conglomerate continues upwards to a maximum of about seven metres above sea level, where it gives place to cemented calcareous beach sand overlaid by boulders and clay from the adjoining old cliff slope.

The subfossil species of this recent marine terrace include the following shells, all of which are living species:

Section 1596 (Hundred of Yankalilla).

Phasianella variegata
Austrocochlea sp.
Cantharidus eximius
Mitra australis
Pyrene acuminata

Section 1588.

Astrea aurea
Austrocochlea sp.
Cantharidus conicus
Salinator fragilis
Calliostoma rubiginosum

The general physiographic evidence is that Kongarati Cave was excavated (primarily by marine erosion) at the level of the raised beach described above. Further slight enlargement has proceeded partly by the weathering from the roof of flakes of slate. This weathering has been assisted by the formation of salt crystals on the roof. The occupational debris in the cave has collected since the final retreat of the sea: it rests directly on the marine shingle and, even in the lowest layers, is formed of undecomposed materials.

(2) Madigan, C. T., Trans. Roy. Soc. S. Aust., 49, 1925, pp. 198-212.

ETHNOLOGICAL SPECIMENS.

Fire-making Apparatus. Eighteen split pieces of Yacca flower stem (*Xanthorrhoea* sp.) were found. Their dimensions varied from 6 to 18 cm. in length and 14 to 25 cm. in width, and all bear the holes made by drilling with a round stick

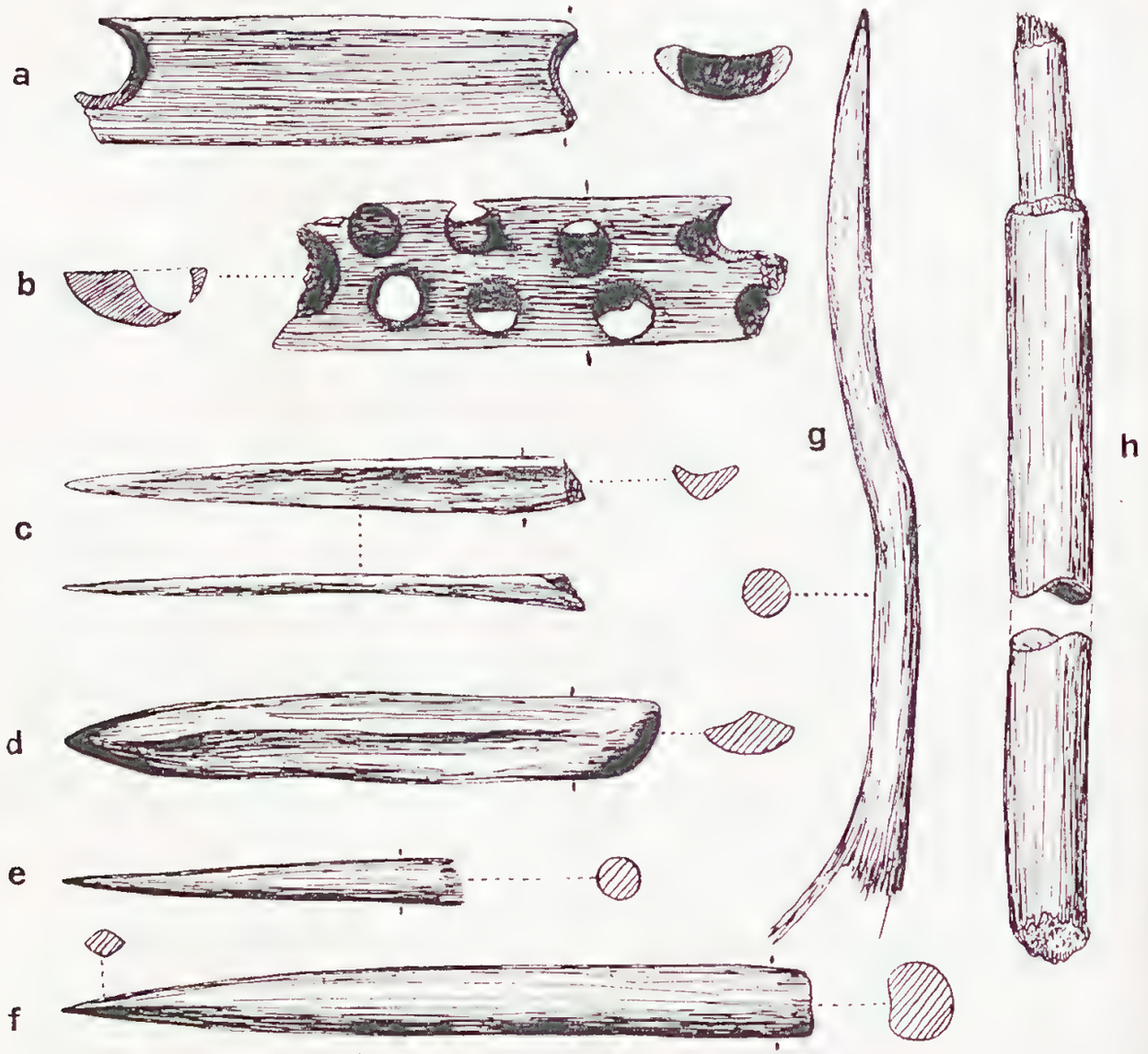

Fig. 5. Implements from Kongarati Cave: a–b, portions of Yacca stems used in fire-making; c, bone point; d–g, wooden points; h, portion of wooden spear.

in the process of making fire. The majority had been used more than once, while one example (fig. 5b) shows nine such holes. In eight of the examples the soft central pith of the Yacca flower stem had been removed, and the edges of the stick worn as though carried about for some time. Several of them had been used at each end (fig. 5a), while in two of them one end tends to taper to a bluntly

rounded apex. The other eight have the central pith intact and sharp edges, suggesting that they were made by splitting the Yacca stem just before making fire. The diameter of the drilled holes varies from 8 to 12 mm., with an average of 10 mm.

A concise description of fire-making is given by Meyer (3) under the heading *nglaiye* ['nla:tji] apparatus for obtaining fire, consisting of two pieces of the flower stalk of the grass tree. A semi-cylindrical piece is placed with the flat side uppermost, and the end of another piece of the same pressed upon it and made to turn rapidly backwards and forwards by rubbing between the palms of the hands. The friction produces fire in the course of a few minutes. This differs from a personal observation of one of us (N.B.T.) in one particular. Milerum, a native of the Tanganekald (or Tangane tribe) of the Coorong, in South Australia, in demonstrating, used a piece of hard wood for the twirling stick.

Nine specimens identified as probably twirling sticks were obtained in the cave. All are of moderately hard wood, the longest being 36 cm. and the shortest 20 cm.; and both of these have been burnt at each extremity. Their diameters vary from 6-14 mm.

Artefacts. Twelve quartz chippings with cutting edges were obtained from the excavation; only one of these showed signs of secondary work. Two rather poor hammer stones were also picked out, one of quartz, and the other of slate. The former had been broken, while the latter showed signs of abrasion on one of the flat surfaces.

Netting. A large number of string and net fragments were recovered from all parts of the occupational layers. Many of the pieces of net were badly decayed, but eight were sufficiently well preserved to be measured. The dimensions were as follows:

* Size of Mesh.	Diameter of Cord.	Material.	Size of Fragment.
40 mm.	2·5 mm.	Vegetable fibre	30 × 15 cm.
15 mm.	1·25 mm.	„ „	12 × 30 cm.
15 mm.	1·5 mm.	„ „	24 × 20 cm.
19 mm.	1·5 mm.	„ „	30 × 10 cm.
10 mm.	1 mm.	„ „	2 attached rectangles each 5 cm.
30 mm.	1·5 mm.	„ „	24 cm. long with 3 knots.
20 mm.	2·5 mm.	„ „	15 × 15 tied at one end.
192 mm.	1·5 mm.	?	Tangled and too fragile to unravel.
25 mm.	2·5 mm.	„ „	Strips wrapped about body of woman 150 cm. long.

* Measured along one side of the square.

Meyer (4) describes a farinaceous root called *Warupu*, which grows at Encounter Bay, the nutritious part of which is eaten, and the tougher part used in

(3) Meyer, H. A. E., Vocabulary of language spoken by the aborigines of the Southern and Eastern portions of the settled districts of South Australia. . . . Adelaide, 1843.

(4) Meyer, H. A. E. The native tribes of South Australia, 1879. p.

making string nets. The same writer further states: "It (the string) is composed by roasting the leaves and afterwards chewing them; the leaf then divided longitudinally into four, two of these are twisted together by being rolled upon the thigh, and are then twisted together by being rolled in the contrary way; other lengths are added until as much line is made as is required.

"In the operation of netting, the twine is wound around a short stick which answers the purpose of a needle, and the meshes are formed, and the knot tied by passing the string over and beneath the fingers."

The method of knotting is the same as that used by Europeans, and is figured by Davidson (5) on his map of distribution of knotted netting in Australia. In the more detailed drawing given in fig. 10 the knot is differently drawn, and is not a type present in any of the net fragments found.

Angas (6) depicts natives making string at Encounter Bay some miles south of Kongarati Cave. On account of the large number of net fragments and string found, it is reasonable to suppose that the cave would be a camping place for native fishing parties. Angas, pl. xxi, shows a group of natives fishing with nets at Second Valley, some two miles south of the cave. Associated with this place is an excellent description of the method employed in catching the fish. He writes: "They use a seine about twenty to thirty feet in length, stretched on sticks placed crosswise at intervals. A couple of men will drag the nets among the rocks and shallows where the fish are most abundant, and gradually getting closer as they reach the shore, the fish are secured in the folds of the net."

Fire Tongs. Among the objects taken from the grass bands (Layer 2) was a pair of sticks each approximately 58 cm. in length and 1 cm. in diameter. These are burnt at the ends. Milerum, an old native referred to elsewhere in this paper, recognized them as the [*'wunːupi*] of the Tanganekald natives, i.e. paired sticks for picking fish, etc., off the fire. They were held in the fashion of chopsticks. Worsnop (7) has the following reference to such sticks: "In removing the entrails or any small food cooked in the embers, they would use two small sticks 10 in. or 12 in. long, and about as thick as one's finger . . . . as we should use a pair of tongs."

He does not, however, mention the locality where such sticks were used.

A bone-point (fig. 5c), which was 9 cm. long and 9 mm. wide at the base, was found in Layer 3, 0-2 metres. Wyatt (8), in his vocabulary, gives the word *wanpu*, a bone for stabbing; while Teichelmann and Schurmann (9) used the word

(5) Davidson, D. S., Journ. Polynes. Soc., 42, 1933, p. 258, fig. 1 (but not p. 270, fig. 10).

(6) Angas, G. F., South Australia Illustrated, plate liv, 1847.

(7) Worsnop, Prehistoric arts . . . of the aborigines of Australia, Adelaide, 1897, p. 83.

(8) Wyatt, Manners and Superstitions of Adelaide and Encounter Bay Aboriginal Tribes, 1879, p. 21.

(9) Teichelmann and Schurmann, Vocab. Aboriginal languages of S.A., 1840, p. 54.

[*wauwewitjo*], a pointed bone for sewing, [*wauew*] a kangaroo, [*witjo*] the thin bone of the hind leg of a kangaroo used as an awl or dagger.

The point of the bone was smoothly polished, and had probably been used as an awl.

A pointed piece of wood 105 mm. long and 15 mm. diameter (fig. 5d) was taken from Layer 2, 5-6 metres. It had been roughly split from a circular rod, and might have been a crude form of fig. 5c. Several other wooden points were found. That shown at fig. 5e was 56 mm. in length and 8 mm. diameter; another (fig. 5f) was 130 mm. long and 15 mm. diameter, and a third (fig. 5g) was a much bent point 158 mm. long and 8 mm. diameter. The examples illustrated in figs. 5f and g were not localized, but fig. 5e came from Layer 2. The three latter specimens bear a strong resemblance to the points of light throwing spears.

Fig. 5h shows a spear junction 27 cm. long, the larger portion being 24 cm. and the shorter 3 cm. in length. The greater and lesser diameters were 9 and 15 mm. respectively. A fragment of wood 20 cm. long, and resembling a portion of the handle of a throwing stick, was also found.

Chewed Masses of Fibre. A number of masses of fibrous material, obviously chewed by the natives, were found in almost all parts of the occupational layers.

Kangaroo Skin Cloak. The skin covering the burial was of particular interest. The skin had been cut to an irregular shape, and edge pierced with holes about 4 to 5 mm. in diameter. The skin had been repaired in several places with cord, similar to that used in the nets; the other portions of skin surrounding the body were much crumpled and decayed, but these also showed signs of holes at the edges. The various fragments were not joined together even when first examined, although pieces of string in several of the pierced holes suggested that the whole formed a skin cloak, such as was used by the natives in inclement weather.

THE DESSICATED BODY.

The body as shown in fig. 6 was lying in a flexed position. It had evidently been smoke-dried by a similar method to that described by several early writers, notably Taplin ([10]).

After removal of a crumpled bundle of skin from between the knees and in front of the face, it was apparent that the body was moderately well preserved. The face was distorted in drying.

The greater part of the skin has been preserved in a shrunken condition. The dried, flattened breasts could be plainly seen; the vaginal orifice is visible, but not not easily owing to the position of the thighs. The hands and feet were in place

([10]) Taplin, G., Native tribes of South Australia.

when found, but, being partly decomposed at the wrists and ankles, became detached when the body was disturbed.

The skin is of a dull brown colour, but the true tone is masked to some extent by the all-pervading traces of salt.

Fig. 6. Dessicated body, Kongarati Cave.

The nose showed hair within the nares, and there was a small amount of short fine hair upon the upper lip The eyebrows were distinct, moderate in quantity, and a duller brown than the hair.

Hair is present on the left parietal, right posterior temporal and occipital regions of the head. Some of the best preserved parietal portions are 5 cm. to 7 cm. long. At the occiput it is 2 cm. to 3 cm. long, and on the posterior temporal region it is about the same length. On the left eyebrow are well preserved hairs.

The skin of the back, especially along the midline crest of the vertebral column and the crests of the ilium, are slightly but definitely charred, and a certain amount of fatty matter has come into the skin and on the surface, mostly on the right side. This fatty matter also appears in the region around the anus, making the tissues

softer and moister than in other parts, so that decomposition has taken place. On the right or lower side, as the body was lying, the skin had decomposed and fallen away from the ribs. This would suggest that the position of drying was one in which the body was lying on the right side in the flexed position as found, but with the head higher than the pelvis.

The chest appears somewhat distorted. The sternum and cartilaginous parts of the ribs are depressed backwards, especially on the right side, so that the ribs at the junction of the bony part point forward. This indicates a crushing together of the lateral walls of the thorax.

Pulpumini (Reuben Walker), one of the oldest of the half-caste natives of the Murray Mouth, who died in 1935, told writers that members of the Ramindjeri tribe pounced on a dying person, forcing out the last breath. They then folded the limbs, trussed the body in a flexed position, and after keeping it for some time "smoked" it over a slow fire.

In the present instance it seems likely that the forcing out of the last breath was responsible for the distortion of the thorax.

There are no fractures of limb-bones, or dislocations of joints. A series of X-ray films was taken. One of the skull shows a possible injury in the frontal bone.

Through an opening in the back, the internal organs could be seen, moderately well preserved.

Dr. T. D. Campbell has reported that the radiographs "are not sufficiently definite to give any very clear idea of the dentition. It would appear that almost, if not all, the full complement of teeth is there. The amount of wear discernable indicates that attrition was fairly marked. Several teeth seem to have a considerable portion of their crowns worn away, almost down to gum level. It is difficult to say whether any of the teeth were affected by caries; most of those seen clearly in the pictures seem to have the remaining portion of the crown quite intact."

Careful measurements of the various parts of the body gave a height of 155 cm. (5 feet 1 inch). The average height of Central Australian women over 50 years of age is 155·5 cm. The teeth and bones as revealed by the radiographs indicate that the age is 50 years or older.

The association of fishing nets with burials was noticed at Princess Charlotte Bay, in North Queensland, by Hale and Tindale ([11]). In this locality, old fishing nets are worn by men during mourning ceremonies.

The dessicated remains of an aboriginal child found on the banks of the Murray ([12]) was packed in wallaby skin and grass, the whole being contained in a net bag, which had a mesh similar to that found in Kongarati Cave.

([11]) Hale, H. M. and Tindale, N. B., Records of S. Aus. Museum V, 1933, p. 95 and fig. 73.

([12]) Sheard, H. L., Mountford, C. P., Hackett, C. J., Trans. Roy. Soc., Aug. 11, 1927, Vol li, p. 173, pl. xii.

The story of Tji:rbuki, which is published in a somewhat anglicized form by Ramsay Smith (13), was obtained by one of us (N.B.T.) from Karloan, an old native of the Jarildikald (of Lake Alexandrina). It is quoted here because of its reference to the use of caves as burial grounds, and its setting within the district under discussion.

STORY OF [TJI:RBUKI] (14): A LEGEND OF THE PEOPLE OF RAPID BAY.

Tji:rbuki was born (started) at [Wa'ti:raŋeŋgul], also known as [Wataraŋalaŋ], which is near Mount Hayfield, and about five miles south-west of the Bald Hills, on Sections 1100-116, Hundred of Yankalilla. In the winter time he lived in the scrub land at [Wati:raŋeŋgul] (literally this means the "Two Hills", and is derived from the story of two men, Lepuldawi and Watiriorn, whose camp it was), and in the summer he went down to Rapid Bay near ['Wita'wateŋ] (Rapid Head), where his "track" (i.e. his hunting territory) extended to the coast.

One day he heard a rumour that his sister's son ['na:ŋari], reciprocal [wan:u], known as [Kulultuwi], had been killed at [War:pari] (the Sturt Creek at Marion). [Tji:rbuki] thereupon travelled to [War:pari] to discover the truth. He found that his [na:ŋari] had been struck down, and that the deed had been done just as the boy was raking the head of an emu from a fire (the steam coming from its bill indicated that it was cooked). The youth had broken a prohibition which forbade him to kill emus. The body of the boy had been taken to a place near Brighton to be "smoked" and dried.

When [Tji:rbuki] arrived he took the body back to a spring on the beach at Marino (the spring on the Kingston Park Reserve foreshore), and there completed the smoking process. Many people assembled for the rituals. Here he learned the names of the two men who had killed his ['*na:ŋari*]. When the body had been smoked [Tji:rbuki] said, "I go back now".

Carrying his [na:ŋari] he walked along the coast until he came to a place near Hallett's Cove, where he rested with his burden. As he reclined he began to think about his nephew, and burst out crying [ka'reil*d*un] (15). The tears ran down

(13) W. Ramsay Smith, Myths and legends of the Australian Aborigine, p. 331.

(14) Also pronounced Tjilbruke, Tjelbruke, Tju'erbruke. These words and all native words in the present paper, other than those quoted from early authors are spelt according to a system used at the University of Adelaide. See Tindale, Records S. Aust. Mus. V, 1935, pp. 262-265.

(15) The indeterminate vowel sound ə and the consonant *d* have not hitherto been used in our transcriptions. The latter is a *d* sound pronounced with the tongue placed in a position between the teeth and indicated in our notation by an italicised *d*. It was first noticed by Prof. J. A. Fitzherbert and one of the present writers (N.B.T.) during the recording of some 'Jarild 'kald legends. The corresponding *t* sound is represented in the place name Potarta:ŋ, recorded in the present paper.

his face, and where they fell to the ground a spring of water welled up; the natives go there to camp because of the spring. He then journeyed to [ˈTainbaˈraːŋ] (Port Noarlunga), where he burst into fresh tears. He went on to [Potartaːŋ] (Red Ochre Cove, Section 362, Hundred of Willunga), where he cried again; yet another spring of water came up. He then walked to [ˈRuːwaruŋ] (a few hundred yards south of Port Willunga jetty). The tide was out. He sat down on the beach and cried once more. The [*ˈluːki*] (tears) dropped on the sand, causing a spring to appear. At high tide the sea covered it, but when the sea went down again water could be obtained by scratching in the sand. It remains so to-day. The old man then carried his nephew's body to the beach at Sellick's Hill, where he noticed a fine bay, suitable for catching sea salmon at night-time. His tears brought a spring into being there. From Sellick's Hill he went along the coast, passing [ˈMaitpaˈŋa] (Myponga) on his left, and came to [Karikaːliŋˈga] (Section 1018 Hundred of Yankalilla) just south of the place known to Europeans as Carrickalinga Head. Here there is a little swamp flat where [*ŋuːri*] grows, very green like a reed (16). Then he went to [ˈKoŋaratiˈŋga], where there is a [perki] (i.e. a cave or hole in the hill). About half a mile south there is a small creek, which is also a camp. Just before Tjiːrbuka reached the [perki] [Koŋaratiˈŋga], he sat down and cried: a small spring flowed there. He did not go into the cave but walked south, passing the mouth of the creek, and travelled along the coastal cliffs, all the way to Cape Jervis [ˈParewarˈaːŋk]. From Cape Jervis he returned northwards along the foreshore below the cliffs, and came to another [perki] or cave called [Jaˈnarwiŋ] (according to another informant). He left the body of his [naːŋari] outside, and walking into the darkness found a place where there was a suitable ledge of rock. He put sticks up, just as was done when the body was being smoked, carried the body in, placed it on the platform, and left it. He did not emerge from the cave, but went on into the depths of the hill for a long way. He eventually came out on the top of the hills near a swamp lagoon. He could see the sun shining through a high crevice. He climbed up, and as he looked about, he said: "Well, there is no use in my living like a man any more."

He therefore transformed himself into a bird, called [*tjiːrbuki*] (a species of ibis), and spent his time catching fish in the lagoon.

Although only a common man [Tjiːrbuki] was a wonderful person. He was not so powerful as [NuˈrunduriJ, but nevertheless had power to influence people.

(16) (Probably Typha). It is possible to make rafts [kandi] of the reed stems of this plant, and indeed the Murray River natives sometimes made them of [*ŋuːri*].

DISCUSSION.

The few implements are reminiscent of the Murundian horizons as defined by Hale and Tindale ([17]) for their rock shelter at Devon Downs.

There are traces of a bone implement culture, but only one stone showing secondary work was discovered. The abundance of firesticks suggests that the cave served as a refuge during inclement weather, or, alternately, as a camping place for fishing parties.

The absence of any form of basketware is remarkable. Angas ([18]) shows a native encampment at Rapid Bay, some four or five miles south, in which a number of mats and baskets of the type used by the Lower Murray tribes can be seen hanging on their shelters. No satisfactory reason can be given for the absence of these baskets.

Since the publication of this paper, Vail ([19]) has described the methods used by the Buang people of Mapos, New Guinea, when preparing their dead for burial. These methods have several points of resemblance with those of the natives who lived in the lower Murray and Second Valley districts.

According to Vail, the body, after death, was flexed, covered with tapa cloth and grass, and securely roped. Drying was carried out by placing the corpse in an underground, grass-packed chamber for a period of from one to five months. At the end of that time the then dried body was taken out, and, after further wrapping, was placed on a ledge or in a cave not accessible to the larger animals, such as dogs or pigs.

In conclusion, the writers desire to thank the many who have assisted in the work of excavation and in the preparation of this paper: Miss Eardley, for the identification of botanical specimens; Dr. E. Couper Black, for assistance in the preparation of notes on the burial; Mr. H. H. Finlayson and Mr. B. Cotton for the identification of the mammals and the shells respectively; and last, but by no means least, the Rev. Lowyck, for his unstinted help and hospitality during the whole time the excavation was in progress.

([17]) Hale, H. M. and Tindale, N. B., Rec. S. Austr. Mus., iv, 1930, pp. 177-183 and 203.

([18]) Angas, G. F., South Australia Illustrated, pl. xxxix.

([19]) Vail, Oceania, vii, 1936, pp. 63-68, pl. A.

A NEW FOSSIL BIVALVE MOLLUSC FROM SOUTH AUSTRALIA

By BERNARD C. COTTON, Conchologist, South Australian Museum.

Fig. 1.

The remarkable occurrence of fossil Chitons in South Australia has been recorded in this publication (1). Amongst the same material taken from the Torrensville Bore by Mr. W. J. Kimber are ten specimens of a Venerid bivalve hitherto undescribed. The generic location has presented some difficulty, but it is here placed in a new genus, and a previously described recent species is cited as Genotype.

GLYCYDONTA gen. nov.

Shell solid, transversely ovate, equivalve, subequilateral ventral margin convex through its entire length; hinge of three cardinal teeth in each valve, and a series of valid crenulations, strongly resembling taxodont "teeth" of the *Glycymerid* variety, arising apparently from the crenulation of the antero and postero-dorsal

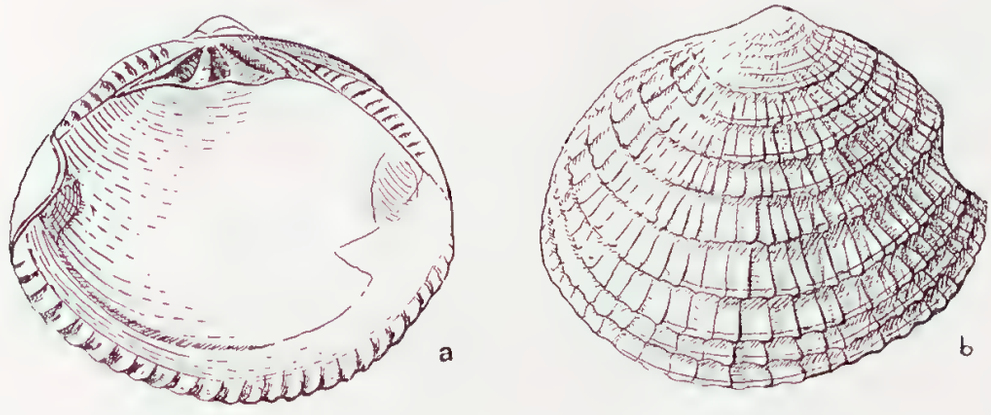

Fig. 1. *Glycydonta protomarica*: a, internal view; b, external view (× 5).

margin by the external radial sculpture of the outer surface; sculpture of concentric lamellae and numerous radials which fimbriate the lamellae; internal ventral margin coarsely denticulate, anterior and posterior much more finely denticulate.

Type *Venus marica* Linn.

Chione marica is recorded from the Philippine Islands, Queensland, New

(1) Ashby and Cotton, Rec. S. Aust. Mus., v, 1936, p. 509, fig. 1–2.

South Wales, and Geraldton, Western Australia (Verco, one valve). There is also a perfect living specimen, from the Verco collection in the S.A. Museum, D. 12886, length, 18 mm.; height, 12·5 mm.; section, 9 mm., labelled "*Chione* (*Omphaloclathrum*) *marica* Linn., Victoria".

The species is widely distributed in the Indo-Pacific, and it is possible that more than one species is represented under this name.

Veremolpa Iredale, 1930 (Genotype *V. ethica* Iredale), which is regarded as a section of *Chione* by Thiele (2), is allied to *Glycydonta*, but whereas *Veremolpa* has only very weak marginal crenulations on either side of the cardinals, *Glycydonta* has a distinct series of taxodont-like "teeth" on either side.

Anomalocardia Schumacher, 1817 = *Cryptogramma* Mörch, 1853 (Genotype *A. flexuosa* Linn. from China) is probably the most nearly allied genus. But in that genus the shell is triangular, unequal and prolonged flexuous, and attenuated posteriorly.

GLYCYDONTA PROTOMARICA.

Shell solid, transversely ovate, hinge as in the subgeneric description, with twelve *Glycymerid*-like "teeth" on either side of the three cardinals; sculpture of about twelve concentric lamellae, with numerous, regular, subordinate radial ribs which fimbriate the concentric lamellae; lunule not well defined, escutcheon obsolete; ventral margin coarsely crenulate internally, crenulations in no way resembling the lateral "teeth" of the hinge. Umbos small, slightly prominent.

Holotype: Length 9 mm., height 7·8 mm., section 5·4 mm.

Torrensville Bore, South Australia, depth 49·0 feet, Upper Pliocene (Reg. No. D. 12888, S.A. Museum). Differs from *Chione marica* in being much smaller, and in not having the lamellae foliaceous on the posterior dorso-ventral angle.

Another species which could possibly be placed with *Chione marica* is *Chione scandularis* Hedley, from Queensland, though this species has much more numerous and finer crenulation on the antero and postero-dorsal border of the hinge.

In concluding, I have to thank Mr. C. J. Gabriel, Honorary Conchologist of the National Museum, Melbourne, and Miss I. Crespin, Commonwealth Palaeontologist, for comparing this species with others in their collections.

(2) Iredale, Rec. Aust. Mus., xvii, 1930, p. 397.

The SOUTHERN AUSTRALIAN BALER SHELL *MELO MILTONIS* GRAY

By BERNARD C. COTTON, Conchologist, South Australian Museum.

Fig. 1-2.

In 1878 Angas (1) recorded the Southern Australian Baler Shell under the name of *Melo miltonis* Gray (type locality Swan River, Western Australia) from "Fowler's Bay, to the westward of Port Lincoln". Verco (2) recorded three specimens, all dead, taken by the Federal Trawler "Endeavour" in 90 fathoms, off Eucla.

Mr. Elver T. Wheare, of Ardrossan, South Australia, recently took eight living specimens of this rare Baler Shell at Cape Thevenard in 1½ fathoms, and presented two of the specimens to this Museum. A typical example is described below.

Shell large, solid, cylindrical; colour chestnut brown, decorated with triangular white blotches, the acute angles of which (on the dorsum) point towards the margin of the outer lip; aperture yellowish-white, columella and internal margin of the outer lip orange coloured; outer surface of the shell, opposite the outer lip, eroded; whorls three, protoconch large and prominent, of four whorls, rapidly increasing, and differentiated from the rest of the shell by a simple radial lip; growth striae close, with periodical coarse axial costations corresponding and arising from the base of the spines; spines incurved, and present almost to the finishing lip of the protoconch; outer lip thick, concave medially when viewed posteriorly and laterally; columella slightly concave, with four plaits, the anterior three strong, the posterior one weak but well defined. Length 228 mm., breadth 126 mm., height of protoconch 10 mm., breadth 16·5 mm. Thickness of outer lip near margin, 6·5 mm. Cape Thevenard, alive, 1½ fathoms, February 11, 1935, S.A. Museum, Reg. No. D. 11432. Collected by Mr. Elver T. Wheare.

The species may be distinguished from others by the concave outer lip, large prominent protoconch, solidity, and strong periodic axial growth costations.

Large adult specimens are so much eroded that the body whorl is translucid, yet the initial thickness of the shell is apparent at and near the margin of the outer lip, where a large specimen is 8 mm. thick. In juvenile specimens where there has been little or no erosion, the protoconch is axially crinkled subsuturally, and finely obsoletely spirally ribbed. The posterior columella plait is always less developed

(1) Angas, P. Z. S., p. 865, 1878.

(2) Verco, Trans. Roy. Soc. S. Aust., xxxvi, p. 229, 1912.

than the other three. In one specimen it is apparently absent, though there are indications that this is an abnormality, as there is an accumulation of callus deposit over the area where the plait should be. In another the fourth or top plait is entirely absent. One specimen said to come from Streaky Bay has the remains of a

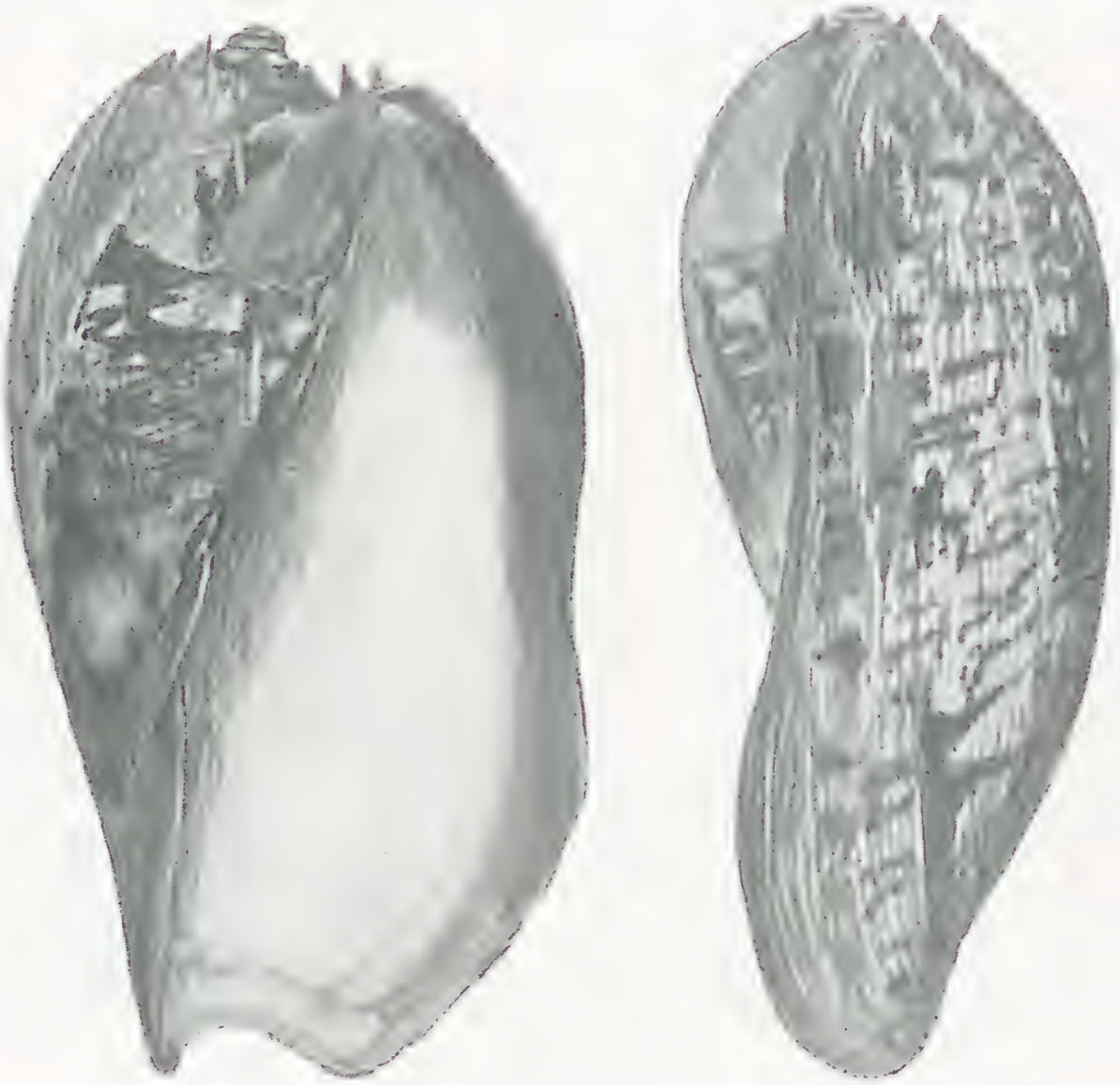

Fig. 1. *Melo miltonis* Gray; ventral and lateral view (× 0·6).

coarse light-brown periostracum, but all other specimens, living and dead, are without a vestige of it.

Mr. Wheare describes the animal as large for the shell, chocolate-brown, with scroll-like white markings. He says the shell is situated with the outer lip vertically above when the animal is at rest or feeding. When in motion the lip is situated laterally, well below the centre line. Unfortunately no specimen with the animal intact has been received at the S.A. Museum, but it is hoped to obtain one shortly.

From the accompanying chart it will be seen that *Melo miltonis* ranges from

Cape Thevenard to King George Sound, living in 1½ fathoms, and dead on the beach, and at 90 fathoms. Our largest adult measures 305 mm. long, though some of the specimens taken by Mr. Wheare were said to be 25 per cent. bigger than this.

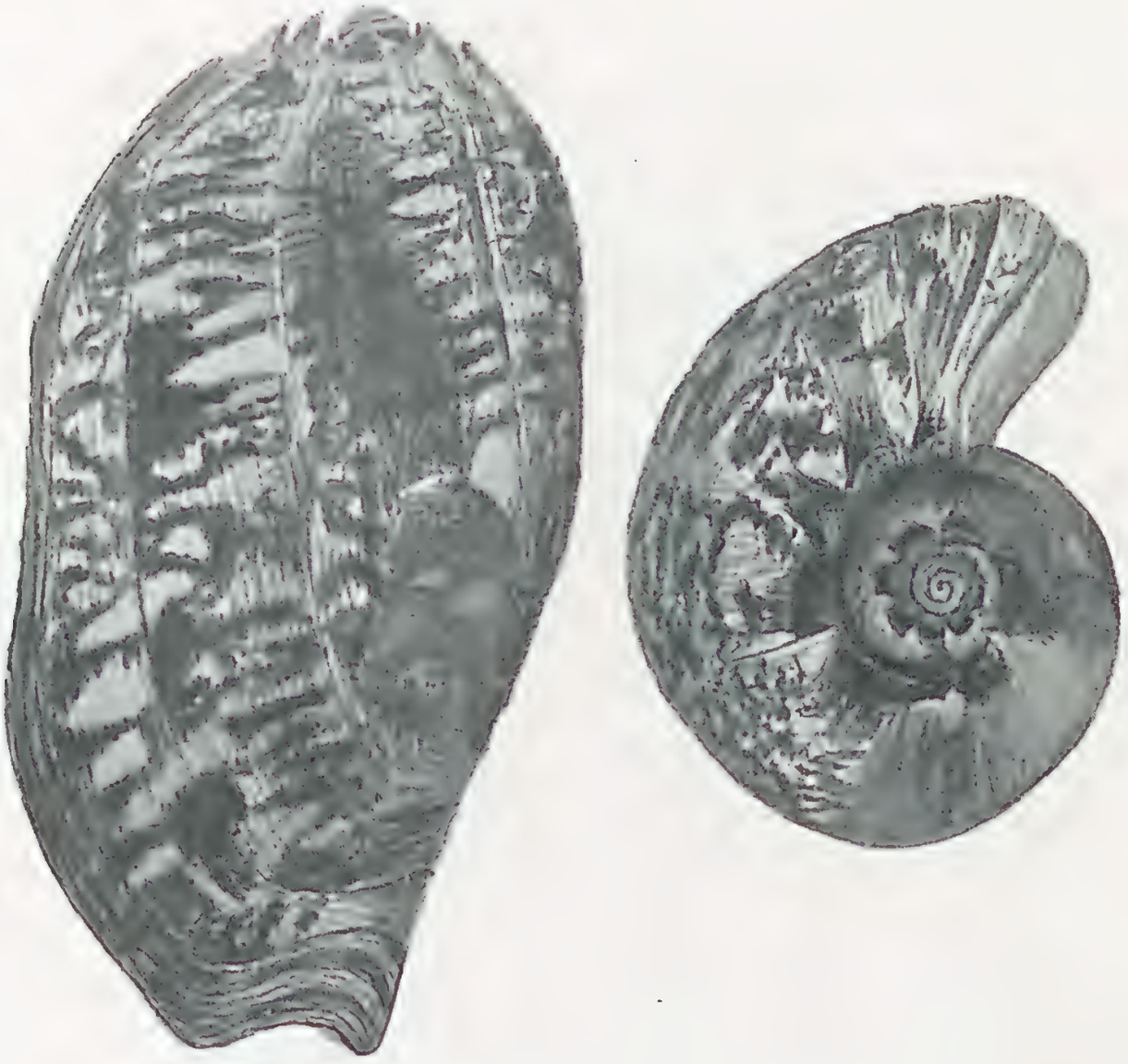

Fig. 2. *Melo miltonis* Gray; dorsal and apical view (× 0·6).

The average dimensions of specimens examined are: length 186·4 mm., width 102·8 mm., height of protoconch 10·3 mm., width of protoconch 15·7 mm. This is easily the largest Gastropod found in South Australia.

Other records of this species are as follows: Mr. G. Spry, of Ceduna, found three living specimens at Decres Bay, south of Thevenard, in 1929, one of which was presented to Rev. Stanley Harper. Rev. B. J. Weeding, of Hallett, found one dead and broken shell at Smoky Bay.

The paintings of *Melo miltonis* Gray here reproduced were prepared by Mr. C. E. Rix.

Locality.	Length.	Width.	Height of Protoconch.	Width of Protoconch.	Columella Plaits.	Reg. No. D.	Collector.	Collection.	Alive or Dead.	Beach or Dredged.	Remarks.
	mm.	mm.	mm.	mm.							
Cape Thevenard	228	126	10	16·5	4	11,432	E. T. Wheare	S.A. Museum	Alive	Dredged	Perfect adult.
Cape Thevenard	292	160	12	17·5	3	11,416	E. T. Wheare	S.A. Museum	Alive	Dredged	Large adult, outer surface much eroded.
Cape Thevenard	305	178	—	—	4	—	E. T. Wheare	Miss Wilson	Alive	Dredged	Protoconch not measured.
Murat Bay	197	102	9	12·5	4	11,418	J. C. Verco	S.A. Museum	Dead	Beach	—
Streaky Bay	185	103	10	12	4	11,419	J. C. Verco	S.A. Museum	Dead	Beach	Juvenile, rather wide.
Fowler's Bay	180	99	10	14·5	4	11,424	J. C. Verco	S.A. Museum	Dead	Beach	Juvenile.
Fowler's Bay	72	40	12	17	4	11,425	J. C. Verco	S.A. Museum	Dead	Beach	Juvenile.
90 miles west of Eucla, 60 miles off shore, 95 fathoms	111	62	12	17	4	11,429	J. C. Verco	S.A. Museum	Dead	Dredged	Juvenile.
King George Sound, W.A.	117	64	10	14	4	7,962	J. C. Verco	S.A. Museum	Dead	Dredged	Juvenile.
Eyre Island	900	120	10	16	4	1,809	A. R. Riddle	S.A. Museum	Dead	Beach	Juvenile.
Streaky Bay	136	80	10	12	4	11,431	O. Klem	S.A. Museum	Alive	Beach	Juvenile with epidermis. Protoconch deformed, a little depressed at the apex.
West Coast, S.A.	150	66	12	15	4	—	—	W. J. Kimber	Dead	Beach	Upper Columella Plait indistinct.
West Coast, S.A.	80	42	10	12	4	—	—	W. J. Kimber	Dead	Beach	Juvenile.
Laura Bay	267	141	12	16·5	3	11,828	C. Blumson	S.A. Museum	Alive	Shallow Water	Large, perfect adult.
Two miles north of Cape Vivonne	244	143	12	17	4	11,828	C. Blumson	S.A. Museum	Alive	Shallow Water	Large, perfect adult.
Cape Vivonne	224	125	14	16	4	12,860	C. J. Blumson	S.A. Museum	Alive	Shallow Water	Perfect adult.
Eucla, 90 fathoms	180	97	10	16	4	12,861	J. C. Verco	S.A. Museum	Dead	Dredged	Imperfect.

SOUTH AUSTRALIAN FOSSIL CHITONS

By EDWIN ASHBY, F.L.S., and

BERNARD C. COTTON, Conchologist, South Australian Museum.

Fig. 1-2.

The three Chiton valves here described constitute the first record of fossil Chitons from South Australia, and Mr. W. J. Kimber is to be highly congratulated on his discovery. Two species were obtained from a bore sunk at Torrensville, and one at Gaza, S.A.

Chiton (Anthochiton) tricostalis relata subsp. nov.

Fig. 1.

There seems enough evidence to separate this subspecies from the species which belongs to that section of the genus, *Chiton* s.s., termed by Thiele *Clathropleura,* and by Iredale and Hull *Rhyssoplax,* but Thiele's name *Anthochiton* dates from 1893, whereas the other one dates from 1910, and thus are synonyms of the subgenus *Anthochiton.*

One median valve subcarinated, side slope convex; angle of divergence 80°, dorsal edge wedge-shaped apparently smooth; the pleural area transversed longitudinally by twelve shallow broad grooves, the ridges (including the outer one) twelve, comparatively slightly narrower than in the species, suggesting weather-boarding; the lateral areas have two strongly-raised, knobby ribs, the anterior one commencing to bifurcate. One can count ten of these ridges or knobs. Nearly the whole surface of the tegmentum is perforated by small holes, undoubtedly exposed by erosion of the surface layer of shell. The network of holes are probably terminals of nerve channels. Inside: tegmentum folded over posteriorly, slits 1/1 well defined, the insertion plate straight, not "frilled" as in the genus *Callistochiton.* The edge is too worn to definitely state that it was serrate, but there are indications that it was not smooth as in the genus *Ischnochiton.*

Holotype. Length 3·5 mm., width 6·5 mm., 490 feet deep, Torrensville Bore, Adelaide, South Australia. Upper Pliocene (Reg. No. D. 12883, South Australian Museum).

The subspecies differs from the species in having slightly narrower ribs on the pleural area, and the sideslope being more curved.

EOPLAX sub. gen. nov.

Only one median valve of the type species *Acanthochiton adelaidae* (described hereunder) is known. In consideration of which fact we place the species in the genus *Acanthochiton*. If the posterior valve should have more than two slits (1/1) then the species should be referred to as *Notoplax*, and *Eoplax* would consequently be placed as a subgenus of *Notoplax*.

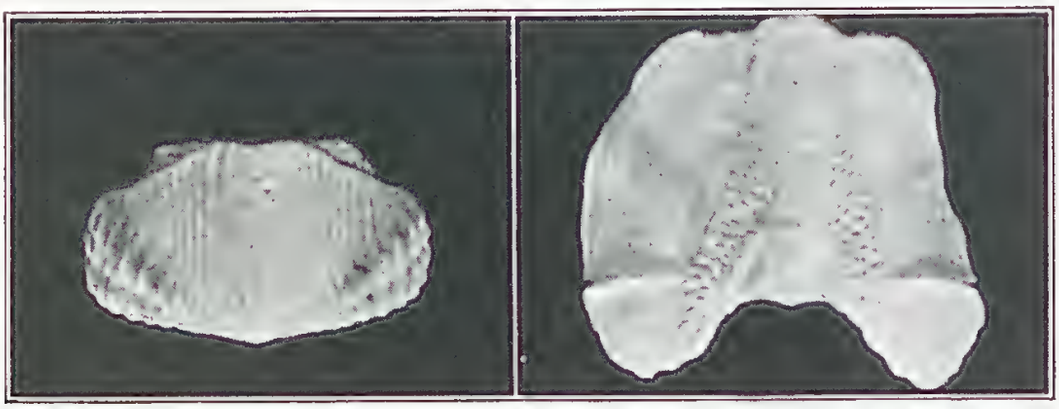

Fig. 1. *Chiton tricostata relata* (× 5·8).

Fig. 2. *Acanthochiton* (*Eoplax*) *adelaidae* (× 5·5).

Differs from *Acanthochiton* s.s. (or *Notoplax* as the case may be) in that the sculpture of the pleural and lateral areas of the tegmentum is reduced to a narrow strip, and does not extend to the suteral sinus by one-quarter the longitudinal width of shell.

The type species *Acanthochiton adeladae* here described possesses a marked though blunt beak, and an exceptionally raised ridge from the slit to the tegmentum on the insertion plate, also the tegmentum is much retracted in width.

ACANTHOCHITON (EOPLAX) ADELAIDAE sp. nov.

Fig. 2.

One median valve, carinated, sideslope straight, angle of divergence 90°; dorsal area keeled, slightly beaked; area long and narrow, the anterior margin 2 mm. wide, converging posteriorly to a width at the beak of ·75 mm.; sides of area straight, surface probably ungrooved, but shallow growth lines present. Pleural and lateral areas inseparable, the tegmentum much reduced; sculpture of pleural area terminates anteriorly at 1·5 mm. from the anterior margin of the dorsal area, and consists of longitudinal rows of flat, triangular, scale-like grains, shaped like an isosceles triangle, the plural and lateral areas inseparable, except that the grains

of lateral area are a little larger. Articulamentum: sutural laminae are too damaged to determine; sinus between evidently rather broad; insertion plates very broad, showing a strong caloused broad ridge commencing at the slit and ending on one side of the tegmentum, but suggesting in the other side (which is damaged) that it may have been continued across the tegmentum, forming there a shallow ridge. The marked feature of this *Acanthochiton* is the extreme reduction laterally of the tegmentum.

Holotype. Length 7 mm., width 7·5 mm., 490 feet deep, Torrensville Bore, Adelaide, South Australia. Upper Pliocene (Reg. No. 12882, S.A. Museum).

? ISCHNOCHITON.

One minute tail valve. Shell raised, mucro well defined, posterior slope at first steep and then becoming flatter towards the outer edge; three rather deep concentric growth grooves towards the outer margin, the portion anterior to the mucro small and largely missing; shows no sculpture other than the continuation of growth grooves of the posterior portion, but under 65 magnification three deep pits can be seen along the diagonal line at the junction of the growth grooves; posterior portion large, sculptured with minute ill-defined grains, otherwise without sculpture except for the growth grooves before named.

But for the three deep pits (seen under 65 magnifications) situated along the diagonal line which separates the anterior from the posterior area in the tail valve, and placed at the junction of the growth grooves, we should have considered it a juvenile of any one of several *Ischnochitons* which have a rather inconspicuous sculpture. The presence of these pits in the tegmentum is so striking that it will, if this feature is retained into maturity, probably remove it from the genus *Ischnochiton* s.s. Further the articulamentum of the inside is too damaged to aid in the decision.

The broken edge of the articulamentum suggests multisletting, the whole surface of the inside of the shell is perforated by intermittent concentric slits when seen under 65 magnifications.

Gaza, South Australia, 80 feet. For the present we place it under the genus *Ischnochiton*, and the presence of the three pits above described may justify it being distinguished as a new species.

Associated with the two Chiton valves from the Torrensville Bore were the following Upper Pliocene Mollusca: *Corbula pixidata* Tate (affinis), *Pelicaria howchini* Cotton (juveniles), *Turritella murrayana subrudis* Cotton and Woods, and *Turritella acricula adelaidensis* Cotton and Woods.

A number of genera, as listed below, were also recognized, but none of the species are recent.

Haliotis, Emarginula, Gibbula, two species; *Fossarus, Euchelus, Uber,* two species; *Phasianella* allied to the recent *variegata,* also numerous opercula different from the recent; *Trophon, Cominella, Clanculus* allied to *yatesi; Nassarius,* two species; *Turridae,* six species; *Ancilla* allied to *edithae; Cymatiella, Bembicium, Astrea, Pyrene,* two species; *Murex,* small; *Terebra, Vermetus, Dentalium,* two species; *Retusa, Calyptraea, Cerithium,* six species; *Marginella,* three species; *Pyrene, Anapella,* two species; *Venericardia* related to *bimaculata*; *Chioneryx* allied to *cardioides*; *Katelysia* juveniles; *Limopsis,* two species; *Myadora, Lucina, Thracia, Placamen, Neotrigonia, Nucula*; one specimen of a species closely related to the recent *Cosmetalepas concatenatus* Crosse & Fischer. Also a few specimens of a bivalve described elsewhere in the present part of this publication.

SCOLYTIDAE AND PLATYPODIDAE

CONTRIBUTION 35

THE COLLECTION OF THE SOUTH AUSTRALIAN MUSEUM

BY KARL E. SCHEDL.

Fig. 1-2.

THE South Australian Museum has recently placed their entire collection of these Coleoptera, including a number of types, at my disposal. Through this kindness I am now able to clear up some of the more doubtful species of the two families, publish some very interesting notes on the geographical distribution of known forms, and finally describe a number of new species. Especially interesting is a new species of the genus *Scolytotarsus* Schedl, which was originally described from Africa, and has now been found in Australia.

PLATYPODIDAE.

CROSSOTARSUS MNISZECHI Chap.

Queensland: Cairns district (A. M. Lea). North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

CROSSOTARSUS BARBATUS Chap.

The description was prepared from specimens from the Moluccas Is., Ceram and Bouru. A new record is North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

CROSSOTARSUS SUBPELLUCIDUS Lea.

This species, which is represented by specimens from Queensland, Cairns district, belongs to the *Crossotarsi barbati* group, and is closely allied to *C. kuntzeni* m.

CROSSOTARSUS KUNTZENI Schedl.

North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

CROSSOTARSUS ARMIPENNIS Lea.

Both sexes are in the South Australian Museum collection from Queensland, Cairns district.

CROSSOTARSUS OMNIVORUS Lea.

Tasmania. New South Wales. Queensland: Blackall Ranges (A. M. Lea); ex Walnut (J. H. Smith), Coll. Imp. Inst. of Entomology, London.

CROSSOTARSUS MAJUSCULUS Samps.

North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

CROSSOTARSUS LACORDEIREI Chap.

New Guinea: Wareo, Finsch Haven (Rev. L. Wagner). North-East Papua: Mt. Lamington (C. T. McNamara).

CROSSOTARSUS PERNANULUS Schedl, fem. nov.

Besides the male of this species, described from the Philippine Islands, I now find the female in a long series of both sexes from Australia. The Australian specimens are somewhat the larger. The female is larger, 2·7 mm. long, more slender, nearly five times as long as wide, the front flat, finely punctured, and also separated from the vertex by an acute angle; the pronotum is as in the male, the elytra are more slender, each rounded behind and furnished with a short brush of reddish hairs.

Types in the Imperial Institute of Entomology and in my collection.

Locality. North Queensland (J. H. Smith): ex Bolly Gum and Sparooa. Gaagarra, March 22, 1934.

PLATYPUS LUCASI Chap.

North-East Papua: Buna Bay and Mt. Lamington (C. T. McNamara).

PLATYPUS JANSONI Chap.

This common species has been taken taken at Finsch Haven, New Guinea (Rev. L. Wagner).

PLATYPUS EMDENI Schedl.

Second record New Guinea: Komba (Rev. L. Wagner).

PLATYPUS SOLIDUS Walk.

Queensland. New Guinea: Wareo, Finsch Haven (Rev. L. Wagner).

PLATYPUS CUPULATUS Chap.

New Guinea: Wareo, Finsch Haven (Rev. L. Wagner).

PLATYPUS PALLIATUS Chap.

North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara). New Guinea: Wareo, Finsch Haven (Rev. L. Wagner).

PLATYPUS LEPIDUS Chap.

New Guinea: Wareo, Finsch Haven (Rev. L. Wagner). North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara). Queensland: Cape York.

PLATYPUS CHEVROLATI Chap.

North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

PLATYPUS FORFICULA Chap.

North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

PLATYPUS AUSTRALIS Chap.

This species is distributed over the entire eastern portion of Australia. Specimens in the Museum collection are from Queensland: Kuranda (Hale and Tindale, Dec., 1926), Cairns district (F. P. Dodd and A. M. Lea), Malanda (G. F. Hill), Brisbane (A. M. Lea, Feb., 1922). North Queensland (Blackburn coll.). New South Wales: Dorrigo (W. Heron), Lismore, and Tweed River (A. M. Lea, Feb., 1922).

PLATYPUS OPACIFRONS n. sp.

Besides a single specimen, male, in my own collection, I have now seen two female specimens from New Guinea. The new species is one of the larger members of the *Platypi sulcati* group, and is easily recognized by the sculpture of the pronotum and the declivital armature.

♂ Piceus, 10 mm. long, 3·3 times as long as wide. Front flat, feebly depressed, densely areolate, the margins more shining, median portion opaque, towards vertex somewhat angulately rounded. Antennal scape longer than wide. Pronotum shining, subquadrate, minutely punctured, the median sulcus fine, surrounded by a short oval transverse patch of densely-placed punctures. Elytra wider (31 : 28), and 2·0 times as long as pronotum, sides parallel, rather narrowly rounded behind,

cylindrical, obliquely convex in the apical fourth; disc striate-punctate, the strial punctures very small and indistinct in most of the striae; striae I and II sulcate throughout, the others near the declivity only, the interstices sub-convex to convex, shining, sub-impunctate, the first, third, fifth, and seventh ending in recessed spines on the upper limit of the declivity, that of the first being the shortest, the third the longest and bent outwards; interstices 2, 4, 6, and 8 end abruptly as broad sub-recessed processes, the declivital face sub-shining, irregularly punctured, and with a large stout spine in lower half on fifth interstice. Abdomen normal.

♀ Larger but more slender, 10·6 mm. long, 2·1 times as long as wide. Front opaque, feebly impressed, and with very small scattered punctures which are noticeable under a very strong magnification only; median line developed as a dark shining line from vertex down to below middle. Antennae as in male. Pronotum more slender (32 : 27), the femoral grooves visible as very wide shallow lateral depressions, the patch of punctures more pear-shaped. Elytra but little wider than pronotum, 2·0 times as long as pronotum, parallel sided and broadly rounded behind; the sulci more shallow, the strial punctures more indistinct than in the male; the base of first four interstices granulate, the third with the longest patch, declivity convex, more steeply than in male, the lower two-thirds sub-perpendicularly aplanate, above and before this face with a transverse impression on each side, the face with a low protuberance on each side near lateral margin; the entire declivity covered with reddish rather long hairs. Front tibiae of both sexes with coarse transverse carinae.

Types in the South Australian Museum (♀) and in my collection (♂ ♀).

Locality. New Guinea and Bougainville. Solomon Is. (Rev. A. H. Voyce).

PLATYPUS SUBGRANOSUS n. sp.

♂ Reddish-brown, 4·1 mm. long, 3·4 times as long as wide. Similar in appearance to *P. semigranosus* Samps., but larger and more slender. The granules of the first interstice of the elytra indicate that this species must be placed in the *Platypi dorso-sulcati* group. Front flat, shining, sparsely and irregularly punctured anteriorly, subopaque, densely areolate, and with short, yellow pubescence above. Pronotum shining, but little longer than wide, femoral grooves shallow when viewed from above; median sulcus fine, puncturation rather coarse all over, the punctures more densely placed on the anterior half and along median sulcus. Elytra wider (12·5 : 11), and 2·2 times as long as pronotum; sides parallel, broadly rounded behind, cylindrical, rather abruptly convex in posterior third, the upper angle of declivital convexity and the elytral disc distinct; disc striate-punctate, strial punctures round and rather small; all striae impressed, the interspaces feebly

convex, with scattered punctures, the first narrow and with a row of fine granules on its entire length, all interstices becoming finely uniseriately granulate shortly before the declivity, the declivital convexity opaque, with minute irregularly-placed setose granules. In some specimens the granules of the first interstice of the elytra are hardly noticeable.

♀ Of the same colour, but somewhat more slender than the male. The anterior part of the front is somewhat elevated, shining, and more distinctly punctured, the posterior portion roughly areolate, and with the median line feebly impressed above. The pronotum similar to that of male, the punctures finer and more sparsely placed. Elytra very slender, feebly convex behind, perpendicularly aplanate at the apex; base of third interstice widened and densely finely granulate; declivity opaque, with reddish pubescence and minute granules.

Types in South Australian Museum and in my collection.

Locality. Tasmania: Waratah (Lea and Carter) (A. Simson coll.). Queensland: Dividing Range V (Blackburn coll.).

PLATYPUS PSEUDO-OPACUS n. sp.

♂ Dark reddish-brown, 7·5 mm. long, 3·4 times as long as wide. This species resembles somewhat *P. semiopacus* Strohm. Front flat, sub-shining, and finely punctured on epistomal margin, more sparsely punctured on area above as far up as the lower margin of eyes, opaque, and densely roughly punctured, and with yellow pubescence posteriorly, medially with depressed striae. Antennal scape longer than wide. Pronotum shining, quadrate, rather coarsely and densely punctured on the anterior half, the punctures very sparsely placed and very fine behind, coarser and more crowded again along the basal border, median sulcus long, fine, widened anteriorly. Elytra little wider (23 : 20) and 2·2 times as long as pronotum, sides straight, feebly dividing towards and broadly rounded at apex, cylindrical, uniformly convex behind, disc striate-punctate, strial punctures somewhat irregularly placed, the first striae strongly, the others feebly, impressed; interspaces subconvex to flat, with scattered irregularly-placed punctures, fourth narrowed and ceasing before apex as in allied species of the *Platypi sulcati* group, the fused fourth and fifth striae deeply impressed near the base; behind the middle all the interspaces become opaque, at first with an irregular double row of shining coarse granules; towards the declivital convexity the granules decrease gradually in size, and towards the apex they are reduced to a single row of very fine rugosities; the declivital convexity subaplanate below, with a small tubercle on the centre of the face of the second interstice, another one on the apical margin opposite the third interstice, the lower face dull with irregularly-placed minute granules,

the eighth interstice shining, irregularly punctured, widened towards apex and extending to apical fourth of elytra, where it becomes narrowed, somewhat produced and finely serrated on its upper side.

♀ Somewhat larger than male, the sides of elytra more parallel, and the apex more aplanate. Front flat, sub-shining and subimpunctate on anterior half, opaque, very finely and densely punctured above, rounded towards vertex with a horn-like compressed process in the centre of anterior half. Pronotum shining, quadrate, without visible femoral grooves, with rather coarse and densely-placed punctures on anterior half; median sulcus fine but distinct, surrounded by a cordiform transverse patch of densely-placed fine punctures. Elytra with the striae deeply impressed to sulcate, the interspaces convex, the third and fourth densely rugose at base, apical convexity rugose and with yellowish short erect pubescence, the apical triangular perpendicular plate opaque and densely granulate.

Types in South Australian Museum and in my collection.

Locality. New South Wales: Dorrigo (W. Heron).

PLATYPUS QUEENSLANDI sp. n.

♂ Reddish-brown, 3·0 mm. long, 3·2 times as long as wide. This is apparently the Australian form of *P. subgranosus* m.; the new species is decidedly smaller, darker in colour, has the interstices of the elytra comparatively narrower and the striae more impressed in both sexes, and the elytral declivity more abruptly convex in the male. Front flat, shining, densely rugosely areolated, and with a depressed median longitudinal stria, rounded towards the vertex. Pronotum distinctly longer than wide (32 : 27), shining, femoral grooves strongly developed; median sulcus long and distinct, usually with a few coarse punctures around its anterior extremity; surface rather densely covered with punctures of varying size, with a shallow depression on the anterior half on both sides of median line. Elytra wider (31 : 27) and 1·7 times as long as pronotum, of the same general shape as *P. subgranosus* m., the discal striae deep, the punctures confluent to indistinct, the interstices rather narrow, rather coarsely irregularly punctured, except the third which is impunctate, the first extremely narrow and broken by the large punctures into short narrow ridges; in the caudal third all interstices become tuberculate and opaque, irregularly finely granulate, and covered with short yellow pubescence, the apical margin acute; abdomen normal.

♀ More slender, due to the more elongate elytra, the front with the median line finely carinate and elevated below, feebly depressed above; pronotum very sparsely punctured, the few punctures of equal size, reticulate to minutely punctulate, especially on anterior half. Elytra with the striae rather deep, the punc-

tures obsolete, the interstices narrowly convex, sub-impunctate, finely rugose near the base, especially the third, which is also widened up to the suture; declivity feebly convex, granulate, and sub-shining above, perpendicular below, the entire declivity covered with short reddish hairs.

Types in the Imperial Institute of Entomology and my collection.

Locality. North Queensland (J. H. Smith) ex Walnut, Gaagarra, May 4, 1934.

DIAPUS PUSILLIMUS Chap.

Specimens of *Crossotarsus grevilliae* Lea in the South Australian Museum which are either co-types or have been determined by Lea, entirely agree with the description and my compared material of *Diapus pusillimus* Chap.

Localities of this species are Queensland, Cairns district (A. M. Lea); North Queensland, Blackburn Coll. North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara). The Imperial Institute of Entomology, London, also possesses specimens from North Queensland taken from Walnut by J. H. Smith, 10th November and 22nd October, 1930.

DIAPUS 5-SPINATUS Chap.

The only specimens in the South Australian Museum originate from North-East Papua: Mt. Lamington, 1,300-1,500 feet (McNamara).

NOTOPLATYPUS ELONGATUS Lea.

This genus, the type of which I have seen, belongs to the *Tesserocerinae*, and not to the *Platypodinae* as Strohmeyer has stated. It is allied to *Spathidicerus* Chap.

SPATHIDICERUS INTERMEDIUS n. sp.

♂ Dark reddish-brown, 9·6 mm. long, 4·4 times as long as wide. A very distinct species. Head rostrate, front longer than wide, plano-convex, opaque when the hairs are abraded, shining above; vertex separated from front by an acute angle, a kind of protuberance in the middle, with a fringe of long upwardly-curled hairs arising from the anterior portion, a similar but somewhat shorter plush extending from upper half downwards. Pronotum longer than wide (28 : 20); postero-lateral angles feebly, the antero-lateral angles strongly rounded, the femoral grooves visible as a very long and very shallow emargination; median sulcus obsolete, with densely-placed longitudinal striae on more than the posterior third. Elytra wider (22 : 20) and 2·2 times as long as pronotum; sides sub-parallel, feebly

constricted and obliquely convex in the posterior fourth; disc striate-punctate, strial punctures obsolete, first, second, third, fourth, and ninth striae narrowly and deeply impressed throughout, the others on the caudal portion only; interstices 1 to 5 convex and impunctate, the others flat, base of third densely granulate; all interstices more strongly convex towards the declivity, the second ceasing as a short blunt recessed spine, the third similarly ending but the spine extremely long; interstices 4 to 6 reaching the declivital face but narrowed and ending without armature, the seventh and eighth fused at apex to form a short spine which extends but little further behind than the third interstice, the ninth narrow and fused with lateral process which is long, slender, and somewhat incurved, the declivital face oblique, shining, densely rugose, depressed along the suture.

Types in the South Australian Museum and in my collection.

Locality. North-East Papua: Mt. Lamington, 1,300-1,500 feet (McNamara).

SCOLYTIDAE.

DACTYLOPALPUS TRANSVERSUS Chap.

This species seems to be widely distributed in the Australian region. I have found specimens in the collection from the following localities. Queensland: Cape York (H. Hacker). New South Wales: Butlow and Sydney (Froggatt, February 20, 1915). North-East Papua: Buna Bay (C. T. McNamara). New Guinea: Wareo, Finsch Haven (Rev. L. Wagner).

LEPERISINUS BIMACULATUS n. sp.

Reddish-brown, 2·3 mm. long, 2·1 times as long as wide. The first species of the genus to be described from Australia. It is easily recognized by the size, general shape, and sculpture.

Front feebly concave, densely finely punctured, covered with short scale-like hairs. Eyes oblong, oval, nearly touching below. Pronotum distinctly wider than long (34:21), widest near base, postero-lateral angles feebly rounded, base bisinuate, sides sub-parallel on basal half, strongly constricted cephalad, apex narrowly rounded, feebly raised, and with few low asperities; surface densely and finely but shallowly punctured, near the constriction at the sides with few very small granules, densely covered with pale yellow scales of two different types, the one very small, hair-like, inclined and very numerous, the other sub-erect, larger and fewer in number. Elytra but little wider and 2·5 times as long as pronotum; sides parallel on anterior two-thirds, angulately rounded behind; base finely crenulate, cylindrical on more than the basal half, uniformly rounded towards the apex,

deeply striate-punctate, striae narrow, the punctures small and confluent in part, the interstices wide, subconvex, densely finely covered with punctures, each of which bears a small hair-like pale yellow scale, usually three to four punctures across one interstice besides a row of larger erect scales on each interstice. The scales of both types become dark-brown on two transverse bands, one of which extends along the base for a short distance laterad, and is rather broad; the other is narrow, bi-sinuate, and situated shortly behind the middle. The second specimen, apparently a female, has the front evenly convex, but corresponds in all other respects with the other.

Types in the South Australian Museum and in my collection.

Locality. Queensland: Blackall Ranges (A. M. Lea).

FICICIS Lea = HYLESINUS Fab.

This genus corresponds in all respects with *Hylesinus* s. st., and therefore has to be withdrawn.

HYLESINUS (FICICIS) KOEBELEI Lea.

Originally described from Cairns district, it has since been taken at Kuranda by F. P. Dodd, and at Mt. Lamington, North-East Papua, 1,300-1,500 feet, by McNamara. It resembles to a great extent *H. philippinensis* Egg., and I suspect synonymy.

HYLESINUS (FICICIS) VARIANS Lea.

The collection contains specimens from Cairns district, Queensland, and North Queensland.

HYLESINUS WALLACEI Blandf.

Locality. North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara). The female has the front evenly rugose, the elytral interspaces more transversely rugose, and the alternate interstices of the declivity less pronounced.

PHLOESINUS PAPUANUS n. sp.

Piceus, elytral declivity more reddish, 1·9 mm. long, 2·1 times as long as wide. The transverse rugae on the first elytral interstice distinguishes this species from its allies of the Indian Region. Front plano-convex, densely finely punctured, and with short yellow downwardly-directed hairs, with a short fine median carina just above the epistomal margin, which is continued caudad by a wide oval polished space, apparently a sexual character. Pronotum distinctly wider than long, widest

near the base, sides rounded, and convergent from the base to the narrowly-rounded apex, but interrupted by a shallow constriction in front, surface shining, ascending from the apex to the base, closely moderately coarsely punctured, except for a few yellow hairs, without pubescence. Elytra wider (31 : 29), and 2·0 times as long as pronotum; sides parallel on more than basal half, broadly rounded behind; declivity convex, commencing shortly behind the middle, deeply striate-punctate, strial punctures indistinct; interspaces flat at the base becoming narrower and strongly convex towards the declivity, the first narrow throughout, and with tubercle-like rugae near the base and uniseriately tuberculate behind up to the apex, the second widened basally, and here covered with numerous transverse rugae; on the disc and declivity similar to the first, the outer interstices with a few transverse rugae near the base, granulate-punctate on the disc, and tuberculate behind; the declivity sub-opaque, all interstices narrowly elevated, and with a regular row of tubercles, the second narrower than the first and third, the first somewhat more strongly elevated, the first three continued to the apex, the third meeting with the ninth, the others shorter, entire declivity covered with short sub-inclined pale yellowish, scale-like pubescence. The antennal club is large, broadly oval, and with indistinct feebly oblique suture.

Types in the South Australian Museum and in my collection.

Locality. North-East Papua: Mt. Lamington, 1,300-1,500 feet (McNamara).

PHLOESINUS TRANSVERSARIUS n. sp.

Nearly black, 1·7 mm. long, 2·3 times as long as wide. The second species to be recorded from Australia; it is easily recognized by the numerous transverse rugae of the elytra. Front sub-shining, convex above, circularly depressed below, densely finely somewhat roughly punctured below, more regularly punctured on the upper convex portion, the depression surrounded by fringe of moderately densely placed yellowish incurved hairs. Pronotum feebly wider than long, base strongly bi-sinuate, postero-lateral angles only feebly rounded, sides arcuate and narrowed towards the apex, narrowly constricted before the latter, apical margin rather narrowly rounded; surface shining, feebly convex, densely regularly moderately coarsely punctured, and with long sparsely-placed hairs. Elytra but little wider and 1·7 times as long as pronotum; humeral angles rectangular, sides subparallel on basal half, broadly rounded behind, declivity commencing at middle, gradually declivous and convex; disc with hardly visible rows of punctures, the striae impressed but the punctures irregular, confluent, and near the base obsolete on account of the strongly developed rugae; interstices opaque, rather narrow, densely covered with rows of small transverse rugae, especially near the base on

the sides the rugae partly replaced by punctures, the basal half therefore grate-like; on the declivity all interstices become somewhat narrower, more convex, the punctures of the striae more indistinct, the granules of the interstices replaced by small punctures which are placed in irregular double rows on each interspace; each puncture and transverse ruga on the disc bears a short yellowish more or less inclined hair.

Types in the South Australian Museum and in my collection.

Locality. Queensland: Blackall Ranges (A. M. Lea).

PHLOEOPHTHORUS ACACIAE Lea.

Besides the types, which are from Tasmania, there are specimens in the collection from Victoria.

HYLESINOSOMA Lea = ARICERUS Blandf.

My suspicion that these genera might be synonymous has been proved correct. A specimen of *Aricerus eichhoffi* Blandf., which apparently has been in the hands of Mr. Blandford, and which is at present in the Stettiner Museum, entirely corres-

Fig. 1. *Aricerus eichhoffi* Blandf. (*Hylesinosoma fici* Lea), antenna (× 42).

ponds with Blandford's description and with the co-type of *Hylesinosoma fici* Lea before me. The second species of *Aricerus, A. chapuisi* Blandf., is also represented in the South Australian Museum collection.

The genus *Hylesinosoma* therefore must be considered synonymous with *Aricerus* Blandf. and *H. fici* Lea, as such with *A. eichhoffi* Blandf.

ARICERUS EICHOFFI Blandf.

Localities. Queensland: Cairns district (A. M. Lea); Maryborough (E. W. Fischer), Mt. Tambourine (A. M. Lea). New South Wales: Gosford.

ARICERUS CHAPUISI Blandf.

Locality. North Queensland: Tweed River.

The examination of the funicle of the antenna under a high magnification shows that it consists of five segments only, and not seven as Lea has stated.

XYLECHINUS LEAI n. sp.

Reddish-brown, 2·5 mm. long, 2·3 times as long as wide. This represents the variety Lea refers to, in his description of *Ficicis koebelci,* as having no elytral granules, finer pubescence, and the scales more numerous on both the pronotum and the elytra. I have examined this species thoroughly, and find that it has a five-segmented antennal funicle, and belongs to the genus *Xylechinus* Chap. The nearest relative is *X formosanus* Schedl. The latter has the elytra with the strial punctures much coarser, the interspaces narrower and with only a single row of yellow rather long scales.

Front plano-convex, densely finely punctured, with short, pale, and erect pubescence anteriorly. Eyes large, long oval, somewhat narrowed in front, strongly narrowed below. Pronotum distinctly wider than long, widest at base, the latter bi-sinuate, the postero-lateral angles rectangular, sides broadly rounded and convergent towards the apex, the latter rather narrowly rounded, surface feebly convex, ascending from the apex to the base; densely coarsely punctured, towards the antero-lateral angles the punctures are replaced by minute asperities, entire surface covered with scales of two types, the larger ones arising from the punctures, the smaller ones from the interstices. Elytra but little wider (39 : 37), and 2·0 times as long as the pronotum; sides sub-parallel on the basal three-fifths, rather narrowly, feebly angulately rounded behind, declivity convex, and commencing shortly behind the middle; entire surface opaque, rather finely striate-punctate, striae narrowly impressed; strial punctures small, interstices feebly convex, reticulate, and apparently with a row of distinct punctures; each interstice bears a fairly regular row of yellow scales, and numerous much smaller scale-like hairs; first interstice continued to apex, meeting the ninth, interstices 2, 3, and 4 meeting the fused seventh and eighth, others gradually shorter.

One specimen which has the front transversely depressed below, but otherwise corresponding to the others, is believed to be the female.

Types in South Australian Museum and my collection.

Locality. Queensland: Cairns district (A. M. Lea).

DIAMERUS INTERSTITIALIS Lea.

This species has been placed erroneously in the genus *Hylesinus.* The antenna, mounted in Canada Balsam, shows a distinctly seven-segmented funicle, a

solid club which is long oval, not three-segmented, strongly compressed, opaque, and with a strongly angulated polished basal portion. There is no doubt that it belongs to the genus *Diamerus*.

ACACICIS ABUNDANS Lea.

Besides the co-type from Tasmania I have seen specimens from Launceston; South Australia: Lucindale and Feuerheerdt. The genus *Acacicis* Lea should be placed near *Renocis* Casy (*Pseudocryphalus* Sw.).

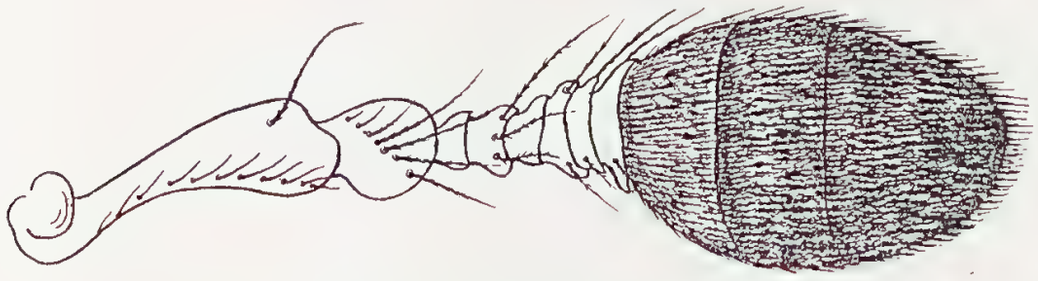

Fig. 2. *Acacicis abundans* Lea, antenna (× 140).

ACACICIS MINOR n. sp.

Dark reddish-brown, 1·3 mm. long, 1·5 times as long as wide. This is the species that Lea referred to as being represented by a single sex only, and which is distinctly smaller than *A. abundans*. As I regard it as a good species it is described below.

Front sub-depressed, polished and sparsely hairy up to the middle of the eyes; antennal club broadly oval, and with two distinct transverse sutures. Pronotum along median line much shorter than wide (25 : 16), widest at base, the latter strongly angulate; sides rounded and convergent to apex, but interrupted by an anterior distinct constriction, the apical margin very narrowly rounded, extended, feebly raised, and armed with a row of small asperities; as the beetle is strongly hump-shaped like *A. abundans*, the pronotum ascends from the apex to the base without a summit; surface densely granulate-punctate, covered with rather long pale yellow scale-like hairs. Scutellum extremely small, hardly noticeable. Elytra wider than long (28 : 25), sides sub-parallel on the basal half, very broadly rounded behind, evenly convex from middle to apex; on the declivity the first two striae distinctly impressed, the second interstice feebly convex; the rest of the surface is densely rather coarsely irregularly punctured, with but very feeble indications of striae, and with short erect bristles which are paler on the disc, darker on the declivity.

Types in the South Australian Museum and in my collectiou.

Locality. New South Wales: Sydney and Wollongong (A. M. Lea).

OZOPEMON PAPUANUS Egg.

This species has again been found in New Guinea. The label says: North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

OZOPEMON GRANULATUS n. sp.

Piceus, 6·4 mm. long, 2·5 times as long as wide. A species easily recognized by its size, feebly convex and uniformly granulate pronotum, and the dense punctuation of the elytra.

Front shining, plano-convex, densely coarsely punctured, longitudinally wrinkled about the epistomal margin, with sparsely-placed long yellow hairs. Pronotum nearly as wide as long, base transverse, sides and apex conjointly broadly rounded, but the sides less strongly so that they appear more sub-parallel; surface feebly convex, summit nearly at the base, uniformly densely granulate all over. The hairs are long and sparsely-placed. Elytra wider (27 : 24), and 1·9 times as long as pronotum; sides sub-parallel on anterior two-thirds, somewhat angulately rounded behind, declivity commencing in the apical third, obliquely flattened, and with round side and apical margins; disc and declivity extremely densely and coarsely punctured; on the former the first striae only, distinctly impressed, the others merely indicated, on the declivital face the suture wide, feebly elevated, and with an irregular double row of small setose granules; first striae strongly impressed, the punctures very large, the second and third with large punctures also, but hardly impressed; interstices 2 and 3 finely granulate-punctate, the entire elytra with erect long reddish hairs. Front tibiae with six, middle tibiae with six, and hind tibiae with seven marginal teeth, all three pairs of equal width and similar form.

Types in the South Australian Museum and in my collection.

Locality. New Guinea: Finsch Haven (Rev. L. Wagner).

PELICERUS NITIDUS var. ORIENTALIS Egg.

Queensland: Cairns district (A. M. Lea). The first record from Australia.

THAMNURGIDES PHILIPPINENSIS Egg.

This Philippine species also has been found for the first time in Australia. Queensland: Cairns district (A. M. Lea).

COCCOTRYPES DACTYLIPERDA Fab.

Queensland: Brisbane. New South Wales: Sydney (April 6, 1921, W. W. Froggatt).

DRYOCOETES DIMORPHUS n. sp.

Reddish-brown, 3·5 mm. long, 2·3 times as long as wide. This species is the first to be recorded from Australia, and apparently comes near to *D. samoensis* Egg.

Front largely covered by the pronotum, as far as visible plano-convex and densely rather coarsely punctured. Pronotum feebly wider than long, base transverse, postero-lateral angles strongly rounded; sides parallel on the posterior half, thence gradually narrowed to the rather broadly rounded apical margin, a feeble constriction noticeable; surface moderately convex, with a transverse summit just behind the middle, very densely covered with moderately large asperities; in front of the base the punctures are large and with anteriorly-raised margins. Elytra as wide as and 1·6 times as long as pronotum; sides parallel on anterior two-thirds, very feebly narrowed behind, and transversely rounded at apex, declivity commencing at caudad third, steeply convex, sub-aplanate; disc very coarsely punctured in rows, the first row distinctly impressed, interstices shining, narrow, each with a rather regular row of punctures which are somewhat smaller, but the interspaces between the strial punctures are so wide and connected with the interstices between the rows that the entire disc has a rather rough appearance, just before the declivital convexity, and on the latter the punctures of the interspaces are replaced by remotely-placed fine granules; between these a few finer punctures are visible, these more numerous and irregularly-placed at the sides. The pubescence of the entire beetle is very long, yellow, and erect. This species is interesting on account of the asperities on the pronotum, which near the apical margin are decidedly smaller than towards the summit.

Types in the South Australian Museum and in my collection.

Locality. New South Wales: Burwood, ex *Pittosporum,* July 12, 1929.

CRYPHALUS MELASOMUS Lea.

This species, which is remarkable through its dark brown scales, has been taken at Sydney, New South Wales, cut out of *Casuarina* (W. Bowley); Brisbane, Queensland, bred from dead branches (H. Hacker).

CRYPHALUS STRIATOPUNCTATUS Lea.

Queensland: Cairns district, and Somerset (A. M. Lea). North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

CRYPHALUS PILOSELLUS Er.

This determination requires checking by comparing with the type. The following localities are represented: Tasmania: Hobart and Launceston (A. M. Lea). South Australia: Mt. Lofty Ranges, Lucindale, and Feuerheerdt.

CRYPHALUS SETISTRIATUS Lea.

Specimens from Cairns district agree well with the co-type variety, but the holotype is required for comparison. They are especially pale in colour although apparently mature.

XYLEBORUS FORNICATUS Eichh.

North-East Papua: Mt. Lamington, 1,300-1,500 feet. (C. T. McNamara).

XYLEBORUS MORIGERUS Blandf.

New Britain: Ratum (F. Dahl. Zool. Museum, Berlin).

XYLEBORUS TRUNCATUS Er.

South Australia: Kangaroo Island and Lucindale (A. M. Lea). New South Wales: Dalby. Queensland (Mrs. F. H. Hobler). Tasmania: Huon River (Lea), Devonport (A. Simson).

XYLEBORUS URSUS Egg.

Bougainville, Solomon Is. (Rev. A. H. Voyce).

XYLEBORUS URSA Egg.

North-East Papua: Mt. Lamington, 1,300-1,500 feet. (C. T. McNamara).

XYLEBORUS DESTRUENS Blandf.

North-East Papua: Mt. Lamington, 1,300-1,500 feet. (C. T. McNamara).

XYLEBORUS WALLACEI Blandf.

North-East Papua: Mt. Lamington, 1,300-1,500 feet. (C. T. McNamara).

XYLEBORUS CORDATUS Hag. = EMARGINATUS Eichh.

New Guinea: Wareo, Finsch Haven (Rev. L. Wagner).

XYLEBORUS ARTESTRIATUS Eichh.

Darwin (F. G. Hill).

XYLEBORUS EXIGUUS Walk.

New Britain: Ratum (F. Dahl, Zool. Museum, Berlin).

XYLEBORUS INDICUS Eichh.

North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara). New Guinea: Wareo, Finsch Haven (Rev. L. Wagner). Queensland: Mulgrave River (Hacker).

XYLEBORUS TESTACEUS Walkl.

New Britain: Ratum (F. Dahl), Zool. Museum, Berlin. New Guinea: Finsch Haven (Rev. L. Wagner). North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara). Darnley Is.: Torres Straits (A. M. Lea). Queensland: Magnetic Is. (A. M. Lea) (Blackburn), Dalby (Mrs. F. H. Hobler), Brisbane (H. Hacker, August 12, 1914) (A. M. Lea), Somerset (G. F. Hill), Kuranda (F. P. Dodd), Stapleton (G. F. Hill), Stewart R. (Hale and Tindale, Jan., Feb., 1928), Bowen (A. Simson), Cairns district (A. M. Lea), Groote Eylandt (N. B. Tindale). Melville Is. (W. D. Dodd). New Guinea: Brisiatabu, Port Moresby (W. N. Lock). The type of *X. hirsutus* Lea apparently, and numerous specimens which have been in the hands of Lea, agree exactly with *X. testaceus* Walk. I have not yet seen the type of *X. parvus* Lea, and am unable to interpret it from the short description.

XYLEBORUS SIMILIS Ferr.

New South Wales: Wearne, Sydney (W. W. Froggatt, December 16, 1923, ex White Ash). New Guinea: Peterhafen, in Kriolobaeumen lebend, Zool. Museum, Berlin.

XYLEBORUS SOLIDUS Eichh.

Having the type of this species before me I find that none of the specimens identified by Lea correspond entirely. They are all somewhat smaller, have the elytral declivity more abrupt and rather more flattened. The pronotum is also stouter. Dissection has shown that they are all females. In spite of these differences I am inclined to believe that they merely represent varieties, which would be more apparent if the type series was a longer one. A similar but distinct species which was included in these is described below.

In the South Australian Museum specimens are represented from the following localities: New South Wales: Tamworth (A. M. Lea), Tenterfield (J. Miller, in cherry, February 19, 1892), Queenbeyan (A. M. Lea), Dorrigo (W. Herron), Brooklane, Sydney (W. W. Froggatt, ex Blue Gum, February 16, 1924), Bangabla, Sydney (W. W. Froggatt, ex Red Gum, March 14, 1924), Canterbury Vale (Cliff). Victoria (French).

XYLEBORUS PSEUDOSOLIDUS n. sp.

♀ Black, 4·1 mm. long, 1·8 times as long as wide. Similar to *X. solidus* Eichh. but smaller, of uniform black colour, elytral declivity more abrupt, declivital face strongly flattened, the wide interspaces densely punctured, etc.

Front plano-convex, finely reticulate, densely coarsely punctured, with a short median carina just above epistomal margin. Pronotum strongly globose, wider than long (24 : 19) ; base transverse, postero-lateral angles rectangular and not rounded ; sides feebly arcuate, and subparallel on more than the basal half, broadly rounded in front, the sides and front margin, which are about similarly rounded, are separated by broadly-rounded antero-lateral angles, summit at the middle, anterior half steep, densely covered with rather coarse asperities, anterior margin produced downwards, and armed with four larger teeth, posterior area shining, finely punctured, the entire pronotum covered with very fine pale erect hairs. Elytra as wide and 1·2 times as long as pronotum, humeral angles feebly rounded, sides parallel on basal half, broadly rounded behind, basal half cylindrical, obliquely truncate behind ; disc shining, very densely, irregularly, roughly punctured with feeble indications on the first two striae only ; declivity flattened on the first four interstices, the first four striae distinct, impressed, and consisting of densely-placed shallow punctures, the fifth striae distinct in median portion only, the first four interstices subconvex, very densely finely punctured, with a row of fine granules on each ; apical margin acute up to seventh interstice, pubescence as on pronotum.

Types in the South Australian Museum and my collection.

Locality. Tasmania : Blackburn coll. New South Wales : Dorrigo, Narara (Hudson, October 16, 1896).

XYLEBORUS NOVAGUINEANUS sp. n.

♀ Dark brown, 2·7 mm. long, 2·6 times as long as wide. The first interstice of elytral declivity is similarly widened as in *X. similis* Ferr., and its allies but otherwise I am disposed to place this species close to *X. tonkinensis* mihi. Front subshining, plano-convex, densely minutely punctulate, coarsely punctured on anterior portion, with sparsely-placed long yellow hairs. Pronotum longer than wide (37 : 34), base sub-transverse, sides broadly arcuate, anteriorly more strongly narrowed than towards base ; apical margin transverse, moderately convex, summit at middle ; anterior area finely densely asperate, posterior portion subshining, very finely and rather remotely punctured. Scutellum distinct, without puncturation. Elytra but little wider and 1·4 times as long as pronotum, widest just behind the middle ; sides straight on more than basal half, broadly rounded behind, declivity commencing behind the middle, evenly convex, shining in the basal fourth ; on the

sides somewhat further behind, opaque on the rest of the surface; disc punctured in rather regular rows, the punctures comparatively small, the interstices flat, each with a single row of fine setose punctures, declivity with the first interstice strongly widened, with a large tubercle in lower half and a smaller one above; on all interstices each second and third puncture replaced by a small granule, more distinctly so on third interstice; apical margin acute, on sides narrowly rounded, and plainly visible up to seventh interspace.

Type in my collection.

Locality. New Guinea.

XYLEBORUS SEXSPINOSUS Motsch.

This common species is represented by large numbers from the following localities. Queensland (Blackburn coll.), Coen R. (W. D. Dodd). New Guinea: Brisiatabu, Port Moresby (W. N. Lock). North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara), Wareo, Finsch Haven (Rev. L. Wagner).

XYLEBORUS 12-SPINATUS n. sp.

♀ Reddish-brown, 2·7 mm. long, 2·0 times as long as wide. This species belongs to the neighbourhood of *X. haddeni* Schedl and *X. dossuarius* Egg., but differs in the declivital armature. Front convex, minutely punctured all over, with few scattered punctures below, impunctate above; the puncturation gives the entire surface a subopaque appearance. Pronotum strongly globose, wider than long (46 : 32), base subtransverse, sides and front margin uniformly rounded, the latter feebly extended and armed with two large and two smaller asperities; summit at middle, anterior area very steep, medially with a few coarse asperities; on the rest of the surface with small and more numerous ones, posterior area shining; extremely finely punctured, the postero-lateral angles obtuse but hardly rounded. Elytra as wide and 1·8 times as long as pronotum; humeral angles strongly rounded, sides parallel on basal two-thirds, angulately rounded behind; cylindrical on basal fourth, obliquely truncate behind; disc shining, with rows of fine punctures; interstices wide uniseriately punctured, the strial and interstrial punctures equal in size and hardly distinguishable; declivital face oblique, shining, very feebly convex, the strial punctures coarse, and all striae distinctly impressed, the interstices wide and shining, the first narrow with a row of minute punctures, the second with a similar row, but the punctures somewhat larger and more remotely placed, the outer more irregularly finely punctured; the apical and side margins acute, raised up to the seventh interstice, near the apex elevated, and with several small granules on first three interstices; just before the declivity the striae one to

six become deeply impressed, and the interstices end in recessed spines, the first interstice shortest and the spine tubercle-like; interstices 2, 4, 5, and 6 gradually longer and the spines short and stout, the third interstice produced further down, strongly callose, and ending in a long-pointed strongly-recessed spine.

Types in South Australian Museum and in my collection.

Locality. North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

XYLEBORUS BIMACULATUS Egg.

Locality. North-East Papua: Mt. Lamington, 1,300-1,500 feet (C. T. McNamara).

XYLEBORUS PUNCTATOPILOSUS n. sp.

♀ Reddish-brown, 2·4 mm. long, 2·0 times as long as wide. Allied to *X. punctulatus* Egg., but with the elytral declivity more gradually declivous. Front plano-convex, opaque, coarsely punctured, with an indication of a median carina. Pronotum much wider than long (39 : 31), base sub-transverse, sides nearly uniformly rounded from base to apex, latter unarmed; surface globose, summit at middle, sub-opaque, anterior area densely but finely asperate, posterior area finely densely punctured; entire pronotum and elytra covered with fine yellowish hairs. Elytra as wide and 1·5 times as long as pronotum; sides parallel on slightly more than basal half, broadly rounded behind, declivity commencing just before middle, gradually obliquely declivous and convex, the entire elytra finely and very densely punctured; under certain lights it appears as if there are small remotely-placed granules bearing apparently longer hairs on the interstices.

Types in my collection.

Locality. New Guinea.

XYLEBORUS LATECOMPRESSUS n. sp.

♀ Reddish-brown, 3·9 mm. long, 2·5 times as long as wide. This species was labelled as a variety of *X. compressus* by Lea. Actually it is a very distinct species not very closely allied to the latter. Front plano-convex, densely coarsely rugosely punctured and sparsely hairy. Pronotum as long as wide, widest at middle, base transverse; postero-lateral angles rounded, sides sub-parallel, feebly arcuate on the basal two-thirds, broadly rounded in front, summit at middle; anterior half very steep and densely asperate, moderately coarsely but rather remotely punctured behind. Scutellum very small and triangular. Elytra but little wider and 1·6 times as long as pronotum; humeral angles strongly rounded, sides parallel on basal two-thirds, broadly rounded behind, cylindrical on more than basal half, declivous, broadly sulcate behind; disc with rows of moderately large punctures, the

interstices wide, flat, and each with a fairly regular row of punctures, which are more remotely-placed but as large as those on the striae; declivity depressed along the suture, the lateral convexities low, the puncturation in general more irregular and smaller; the first striae more or less regular and visible, the others noticeable as shallow depressed discs on close examination, the third interstice bearing two large tubercles, the upper larger one near the apex, a similar smaller tubercle between these on the fifth interstice. The apical margin is not acute. The entire elytra are covered with long yellowish hairs which are more numerous on the declivity.

Types in the South Australian Museum, and my collection.

Locality. New South Wales: Upper Williams R. (Lea and Wilson, October, 1926), Galston (Dumbrel). Victoria: Kewell (Hill, 1877).

XYLEBORUS COMPRESSUS Lea.

This species, originally described as *Xylopertha compressa*, seems to be very abundant in the Australian region. The Museum specimens bear the following locality labels. New South Wales: Tamworth, Galston (Dumbrell), Dorrigo (W. Heron), St. Mary's, Upper Williams R. (Lea and Wilson, October, 1926, ex Pittosporum), Burwood, 19/7/29. Queensland: Blackall Ranges (A. M. Lea), Mt. Tambourine (A. M. Lea), Brisbane, Coats, Bowen. South Australia: Mt. Lofty Ranges (S. H. Curnow), Lucindale, Feuerheerdt, Adelaide (A. M. Lea). Tasmania: Hobart (A. M. Lea), Kelso (A. Simson).

XYLEBORUS FLAVOPILOSUS n. sp.

♀ Dark reddish-brown, 4·0 mm. long, 2·6 times as long as wide. This unique specimen, which I was unable to place for some time, I can now describe after seeing its allies, *X. compressus* Lea and *X. latecompressus* mihi from Australia. Front convex, sub-shining, densely roughly punctured, with a median shining space. The entire beetle is covered with dense short yellow pubescence. Pronotum slightly longer than wide, base transverse; sides sub-parallel on more than anterior half, broadly rounded in front, rather feebly convex, summit at middle; anterior margin with several very low broad asperities; anterior area densely rather finely asperate, posterior area very densely finely punctured, thus appearing sub-shining. Elytra as wide and 1·5 times as long as pronotum, sides sub-parallel on anterior two-thirds, somewhat angulately rounded behind, cylindrical on anterior half, just behind middle obliquely convex, feebly depressed up to the third interstice, the lateral and apical margin not acute but fairly well defined; disc very densely punctured, the striae hardly distinguishable from rest of the punctures; on the declivity with

two to three granules on the third interstice; finely granulate at the sides, more coarsely so in the lower third and along apical margin, the first two striae well marked, feebly impressed, and the punctures distinct, the interstices as on the disc densely multi-punctate. The granules along the apical margin appear under high magnification like the asperities found on the pronotum.

Type in my collection.

Locality. New Guinea.

XYLEBORUS PITYOGENES n. sp.

♀ Reddish-brown, 2·6 mm. long, 2·6 times as long as wide. The locality label on this specimen, "Australia", and the short description of Lea, led me to misdetermine it. It is not *X. compressus* as I at first thought, but a new species. Front shining, subconvex, densely punctured. Pronotum nearly as wide as long, base transverse; sides feebly curved and narrowed to the broadly-rounded apex, apical margin armed with several small low asperities, surface shining, summit distinctly before the middle; anterior area densely covered with small asperities, posterior area rather strongly but not closely punctured. Elytra as wide and 1·6 times as long as pronotum; sides parallel on basal two thirds, broadly rounded behind, each elytron again very feebly separately rounded behind, thus forming a very shallow emargination at the suture; cylindrical on basal half, sulcate, and with three tubercles on third interstice shortly within the summit of the lateral convexities, as in some species of *Pityogenes*; disc fairly regularly striate-punctate, interstices wide, shining, with scattered punctures, declivital sulcus irregularly strongly punctured, apical margin acute.

Type in my collection.

Locality. Australia.

WEBBIA CANALICULATUS Egg.

Locality. New Guinea: Finsch Haven (Rev. L. Wagner).

SCOLYTOTARSUS MACULATUS sp. n.

Reddish-brown, densely covered with scale-like hairs; 4·9 mm. long, 2·5 times as long as wide. This very interesting species, the second of the genus, resembles in general sculpture *S. impar* from the Cameroons, but has a perpendicular fifth sternite on the abdomen. Head very strongly produced downwards and compressed, front concave, very densely roughly and coarsely punctured, with moderately long yellow pubecence which is directed to the median line, the side margins of the front up to the eyes acute, the latter sub-circular and half-spherical; antennal scape stout, funicle seven-segmented; club conical, feebly compressed, and without

noticeable sutures. Pronotum as long as wide, basal margin sub-transverse; postero-lateral angles rounded, sides feebly arcuate, at the base as wide as short before the strongly-produced anterior constriction, apical margin rounded and feebly emarginate in the middle; surface densely coarsely punctured, covered with yellow scale-like hairs which are directed towards the distinctly carinate and impunctate middle line. On a rather large spot in the basal half on each side of the middle line, and a similar smaller one just before the middle, the scales are dark brown, giving at first sight the impression that these spots are hairless. Elytra but little wider (20 : 19), and 1·5 times as long as the pronotum, sides straight, feebly diverging caudad, transverse at apex, cylindrical, and very feebly convex at apex; striate-punctate, the striae deep but narrow, the punctures largely confluent, the interstices wide, flat, with somewhat irregular double rows of densely-placed coarse punctures, the first three feebly widened posteriorly, and extending to the apical margin, the seventh to ninth interstices continued to the third, the others not extending so far but gradually shortened; all interstices with long scale-like hairs, which are of a yellowish colour in the greater part, with two wavy transverse bands of dark brown. Abdomen with first four sternites normal, the fifth after a short cylindrical portion, which is as wide as the second sternite, perpendicularly ascending to the apex of the elytra; this perpendicular face is rugosely punctured and sparsely covered with long erect dark inconspicuous hairs.

Types in South Australian Museum and in my collection.

Locality. Queensland: Coen district, Cape York (H. Hacker).

THE CARRAWEENA, YANDAMA, AND CARTOONKANA METEORIC STONES

By A. R. ALDERMAN, Ph.D., M.Sc., F.G.S.

Fig. 1-7.

The area surrounding the point where the three States of South Australia, New South Wales, and Queensland meet has yielded a number of meteorites, of which the following are in South Australian collections: the Murnpeowie iron and the Accalana, Artracoona, Carraweena, Yandama and Cartoonkana stones. The flat topography and arid climate of the region would appear to be most suitable for the recognition and preservation of meteorites. None of those named above have been seen to fall. This paper is a description of three of the meteoric stones from this area.

The accompanying plan gives the approximate localities of the stones described in this paper, and also of other meteorites which have been found in the area shown (fig. 1). The following is a list of such specimens, and unless otherwise stated the main mass is now in the South Australian Museum.

Name.	Weight.	Type.	Locality. Lat.	Long.
Accalana	6¼ lb.	stone	29° 15′ S.	139° 58′ E.
Alice Springs	2⅔ lb.	pallasite	23° 33′ S.	133° 52′ E.(1)
Alikatnima	35 lb.(+)	iron	23° 20′ S.	134° 7′ E. (2)
Arltunga	40 lb.	iron	23° 28′ S.	134° 40′ E.(3)
Artacoona	45 lb. 14 oz.	stone	29° 4′ S.	140° 0′ E. (4)
Cadell	7½ lb.	stone	34° 4′ S.	139° 45′ E.
Carraweena	63½ lb.	stone	29° 10′ S.	140° 0′ E.
Cartoonkana	10 oz.	stone	29° 45′ S.	141° 2′ E.
Henbury	—	iron	24° 34′ S.	133° 10′ E.(5)
Kappakoola	·86 lb.	stone	33° 20′ S.	135° 30′ E.
Karoonda	92 lb.	stone	35° 7′ S.	139° 53′ E.(6)
Kingoonya	6 lb.	stone	30° 55′ S.	135° 20′ E.(7)

(1) In British Museum of Natural History. L. J. Spencer, Min. Mag., 1932, Vol. xxiii. pp. 38-42.

(2) Two pieces of this iron, weighing 20 lb. and 15 lb., are in the South Australian Museum. A third piece is privately owned in Central Australia.

(3) Mawson, D., Trans. Roy. Soc., S. Austr., lviii, 1934, pp. 1 and 2.

(4) In Mineralogy Department, Adelaide University.

(5) Alderman, A. R., Min. Mag., 1932, Vol. xxiii, pp. 19-32; also Rec. S. Aust. Mus., iv, 4, 1932, pp. 555-563; Spencer, L. J., Min. Mag. 1933, xxiii, pp. 387-404.

(6) Mawson, D., Trans. Roy. Soc., S. Austr., lviii, 1934, pp. 2-5.

(7) In Australian Museum, Sydney.

Name.	Weight.	Type.	Locality. Lat.	Long.
Kulnine	122 lb.	stone	34° 6′ S.	141° 47′ E.
Kyancutta	72 lb.	iron	33° 19′ S.	135° 2′ E. (8)
Lake Labyrinth	75 lb.	stone	30° 20′ S.	134° 45′ E.(9)
Morden	5¾ lb.	iron	30° 30′ S.	142° 20′ E.
Murnpeowie	2,520 lb.	iron	29° 35′ S.	139° 54′ E.(10)
Rhine Villa	7¼ lb.	iron	34° 20′ S.	139° 10′ E.(11)
Silverton	12 oz.	stone	31° 53′ S.	141° 12′ E.(12)
Weekeroo	207½ lb.	iron	32° 16′ S.	139° 52′ E.(13)
Yandama	12 lb. 9 oz.(+)	stone	29° 45′ S.	141° 2′ E.
Yardea	7¼ lb.	iron	32° 25′ S.	135° 30′ E.(14)

No information could be obtained by the writer concerning the so-called Glen-Osborne meteorite, which has been mentioned in various catalogues and papers as a South Australian fall. It is suggested that this fall should be discredited.

CARRAWEENA.

This stone was found in 1914 by Mr. G. Amesbury at about six miles south-west of Old Carraweena Station, in the north-east of South Australia. Its shape is roughly that of a thick right-angled isosceles triangle, in which the base measures approximately 37 cm., the height 26 cm., and the thickness 18 cm. (fig. 2). The weight is 63½ pounds.

The surface shows thumb-marks and indentations on all sides, and is for the most part covered with a brownish-black to black crust. In the small areas where this crust is missing or has been chipped off in examining the specimen, the main bulk of the stone is seen to be of a somewhat lighter shade, being a dull rusty brown.

Although the surface is much cracked the specimen seems to be practically complete, and does not suggest that any notable portion was broken from it as a result of its impact with the ground.

Thin sections show that the essential components of the stone are enstatite, olivine, metallic nickel-iron, and troilite, and that chondrules are plentiful (fig. 3).

The opaque material is largely metallic nickel-iron, with which there is asso-

(8) In Kyancutta Museum, S. Austr., L. J. Spencer, Min. Mag., 1933, xxiii, pp. 329-333.

(9) In Kyancutta Museum, S. Austr.

(10) In School of Mines Museum, Adelaide. L. J. Spencer, Min. Mag., 1935, xxiv, pp. 13-20.

(11) A slice is in the South Australian Museum, Adelaide. The main mass was sent to Germany. G. A. Goyder, Trans. Roy. Soc., S. Austr., 1901, xxv, p. 14.

(12) In Kyancutta Museum, S. Austr. L. J. Spencer, Min. Mag., 1934, xxiii, pp. 569-572.

(13) In Australian Museum, Sydney. T. Hodge-Smith, Rec. Aust. Mus., 1932, xviii, 6, pp. 312-3.

(14) Cloud, T. C., Trans. Roy. Soc., S. Austr., 1882-3, vi, pp. 82-3. Other references in Anderson, C., Rec. Austr. Mus., x, 5, 1913, p. 66.

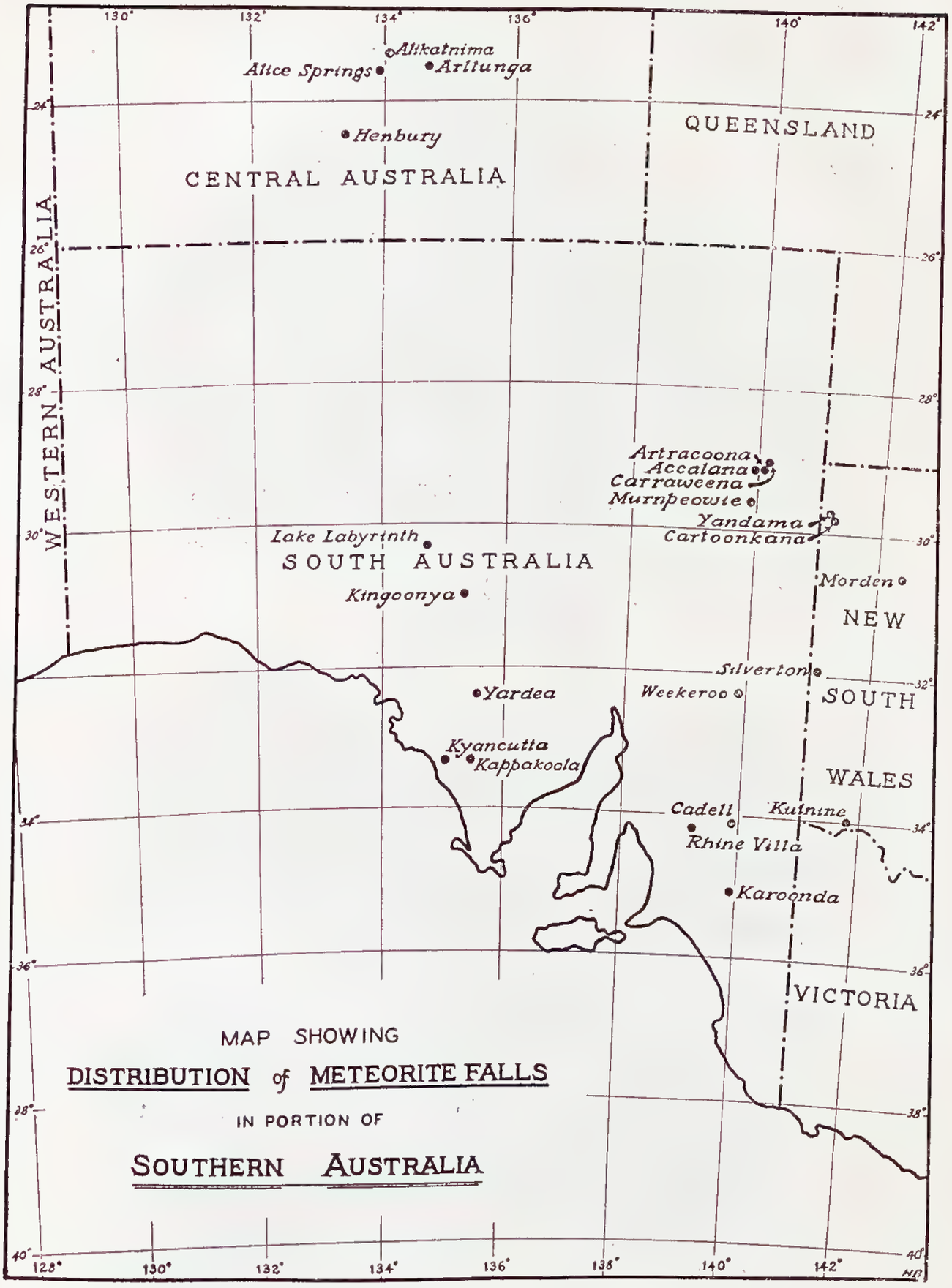

Fig. 1. Meteorite falls in Southern Australia.

Fig. 2. The Carraweena meteoric stone.

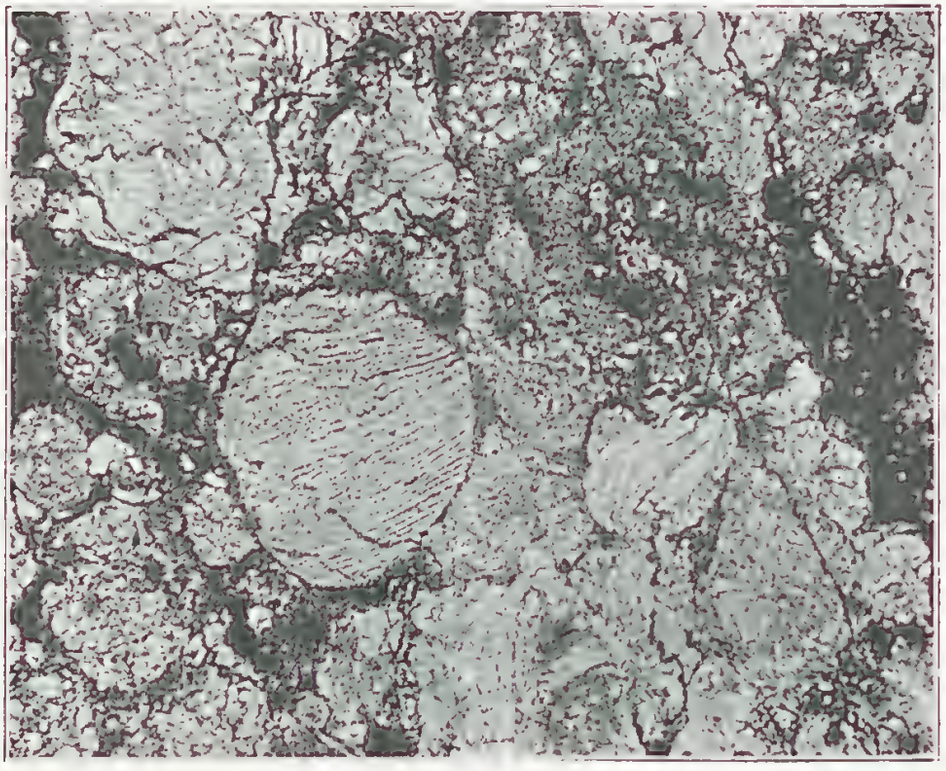

Fig. 3. Micro-section of the Carraweena meteorite. The large chondrule near the centre of the photograph consists essentially of enstatite. (× 20).

ciated a certain amount of reddish oxidation product which is occasionally translucent. Troilite is also present in notable amount. These opaque components occur together in masses of varying size and irregular outline, much of which is in the form of narrow veins which surround silicate grains and chondrules, and occasionally enter the chondrules themselves.

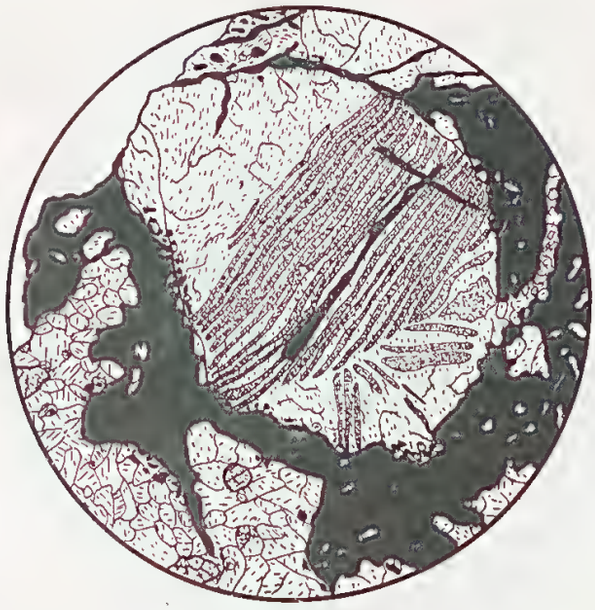

Fig. 4. A chondrule in the Carraweena meteorite. Very narrow bands of darker glass separate enstatite fibres. (× 20).

The silicate components have a generally porphyritic structure, chondritic enstatite and olivine being set in a finer brecciated ground mass which consists essentially of the same two minerals. The chondrules vary considerably in composition, grain-size, and structure, those in which enstatite is the main component being more perfectly developed than others. The differences in the size of the chondrules are considerable, some consisting of fine micro-crystalline enstatite, giving a brush extinction between crossed nicols, while others are made up of large enstatite grains, or granular aggregates of olivine, or of these two minerals together. All gradations between these extremes are also present. Some of the more striking chondrules are of the radiate enstatite type, in which very narrow bands of glass (fig. 4) or of clinopyroxene separate the enstatite fibres. In others a rounded chondritic mass of enstatite is surrounded by an outer zone of the same mineral in a brecciated condition.

The optical properties of both the enstatite and the olivine suggest that the Mg : Fe ratio in each mineral is about 5 : 1, a suggestion which seems to be supported by a consideration of the chemical and mineral composition of the stone. Colourless clino-pyroxene occurs in separate grains, or intergrown with enstatite.

Glass is present in fair quantity, and occurs either as inclusions in porphyritic grains of enstatite or olivine, or as thin bands separating enstatite fibres in chondrules, or as interstitial material. It is a pale brown colour, and in some cases devitrification has taken place.

Small colourless grains occasionally showing polysynthetic twinning appear to be felspar.

The bulk analysis of the Carraweena stone is as follows:

Fe		12·75 per cent.
Ni		1·10
Fe	3·64	5·72
S	2·08	
SiO_2		38·08
TiO_2		tr.
Al_2O_3		5·99
FeO		5·78
MnO		0·20
MgO		24·72
CaO		2·06
Na_2O		1·88
K_2O		0·48
$H_2O \pm$		0·88
Cr_2O_3		0·46
BaO		nil
P_2O_5		0·22
		100·32

The specific gravity has been determined as 3·43.

YANDAMA.

The Yandama stone was acquired by the South Australian Museum from Mr. T. F. Gill in 1914. The locality is given as "Blacks' Camp, Big Plain, Yandama Station, N.S.W." In form this stone is a rounded sub-angular mass, and measures approximately 19 × 14 × 13 cm. (fig. 5). One end of the meteorite, weighing probably a few ounces, has been cut off and returned to Mr. Gill. The main mass, now in the Museum, weighs 12 lb. 9 oz. About half of the surface shows traces of the original skin, which is smooth without thumb-marks or any major indentations. Only very small pittings relieve the otherwise smooth surface, which is of an indeterminate blackish-brown colour. Where the inner material is shown, as on a fractured surface, it is of a somewhat lighter brown. The extent of the fractured surface would appear to indicate the possibility of the stone, as found, having at one time formed part of a considerably larger mass.

Under the microscope it is seen that compared with the Carraweena stone, this aerolite has fewer well-defined chondrules, and that although there is much less metallic material, oxidation has advanced to a far greater extent, and brownish-red limonite obscures much of the ground mass (fig. 6).

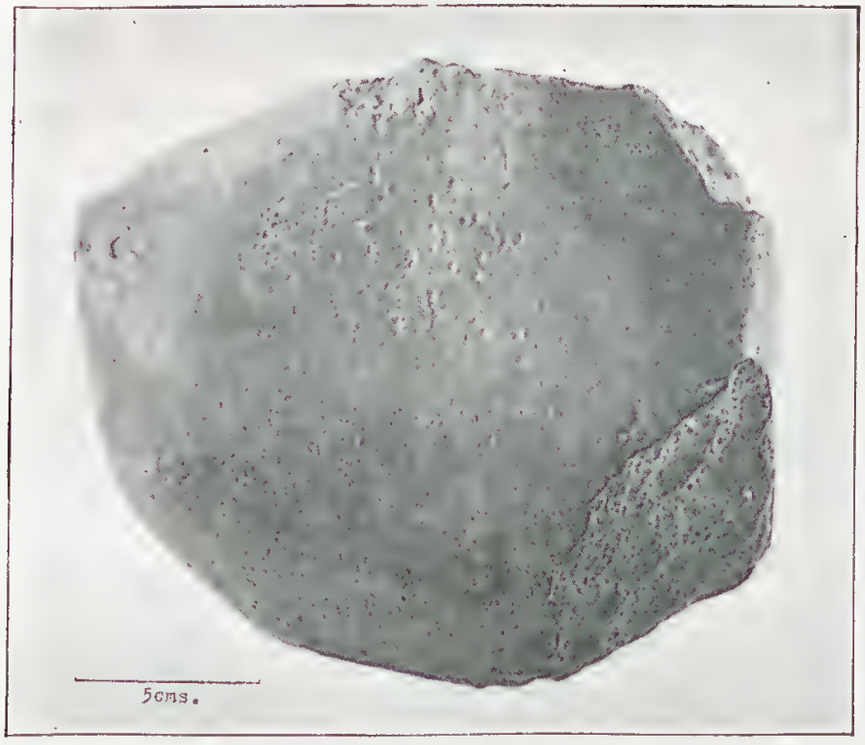

Fig. 5. Photograph of a coloured plaster cast of the Yandama meteorite showing the shape of the stone when found.

Olivine is the main silicate constituent, being in excess of hypersthene. The optical properties of these minerals suggest a higher iron content than that of corresponding minerals in the Carraweena stone. Glass is practically absent, but small grains of felspar, generally untwinned, and having a refractive index slightly higher than the balsam, are fairly common.

The opaque components occur in irregularly-shaped masses and thin veins, troilite being very plentiful. Much limonitic material is associated with the metallic nickel-iron, and obscures the silicate grains in surrounding areas.

The chondrules are for the most part ill-defined, and consist largely of granular aggregates of olivine and hypersthene, the former mineral predominating. More rarely a chondrule is made up of some regular arrangement of fibrous hypersthene and olivine.

A chemical analysis of the Yandama stone gave results as follows:

Fe		5·93 per cent.
Ni		0·56
Fe	3·33	5·23
S	1·90	
SiO_2		37·99
TiO_2		tr.
Al_2O_3		7·36
FeO		14·18
MgO		21·20
CaO		2·00
Na_2O		1·16
K_2O		0·47
$H_2O \pm$		2·59
P_2O_5		0·22
		98·89(1)

The specific gravity as determined by hydrostatic weighing is 3·40.

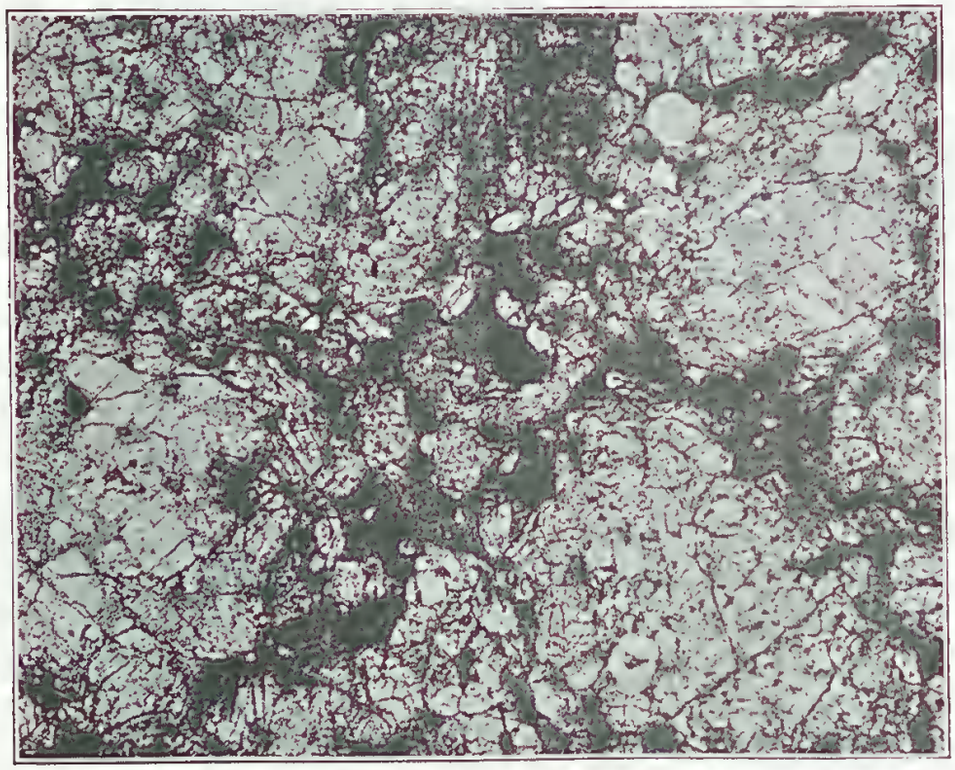

Fig. 6. Micro-section of the Yandama stone. Granular olivine and hypersthene are the essential silicate components. (× 25).

CARTOONKANA.

This small stone, like the one just described, was also acquired from Mr. Gill, and found on Yandama station. The conditions under which it was found did not,

(1) The low summation is probably largely due to much of the iron in this stone being oxidized.

apparently, suggest that its fall was connected with that of the larger Yandama specimen. The late Mr. E. R. Waite, who was then Director of the South Australian Museum, and who knew the region well, suggested applying to this fall the name Cartoonkana, from a neighbouring locality on the station. The name unfortunately does not appear on the New South Wales survey maps.

Fig. 7. The Cartoonkana meteoric stone.

The Cartoonkana stone is small, measuring $8 \times 5 \times 5$ cm., and weighing $10\frac{1}{4}$ ounces (fig. 7). The surface is one of the same general dark-brownish colour as that exhibited by Yandama. One end shows a rough fracture, and portion of the stone is obviously missing. The general shape and arrangement of the patinated surface strongly suggests, however, that the meteorite as it fell was not much larger than it is at present. It would thus not appear to be a fragment broken from the larger Yandama mass. Microscopic examination gives every support to this view. When compared with the Yandama stone, it has fewer chondrules and is less oxidized. Also the metallic iron is in larger fragments, but seems of smaller amount, but this may be due to the presence of so much limonitic matter in the Yandama section increasing the apparent amount of opaque mineral. Olivine and enstatite

are the main silicate constituents. A small amount of a colourless mineral resembling enstatite but giving oblique and indistinct extinction is probably clinopyrozene, although the double refraction seems unusually low. Small grains of troilite are associated with the nickel-iron.

The specific gravity has been determined as 3·33.

The writer is indebted to Mr. R. G. Thomas for the phosphorus determinations in the analyses of the Carraweena and Yandama stones.

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